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An Airplane View of the Wonder City Built with Compressed Air

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Compressed Air Magazine

A digest of compressed air and pneumatic practice, and also of engineering and industrial data germane to allied mechanical arts

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VOL. XXV, NO. II FEBRUARY, 1920

Uses for Compressed Air in the Lumber Industry

By MAJOR WALTER P. BURN

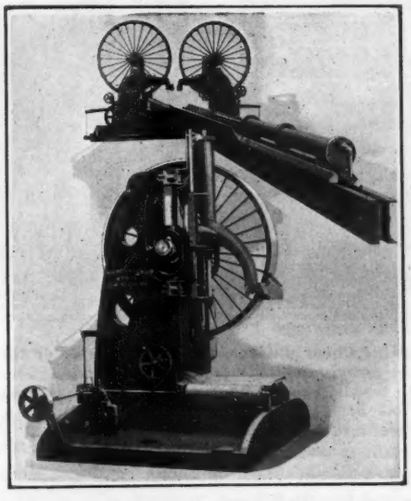
MOST OF US are aware that steel and stone, two of our important structural materials, are dependent upon compressed air for their shaping and handling; the foundryman rams his molds with compressed air, and uses pneumatic chipping hammers to trim the castings: great steel girders are securely riveted into place with the air hammer, while building stone is shaped and chipped and carved with pneumatic tools. But the part that compressed air plays in the preparation of lumber for our needs is comparatively unknown. The uses of compressed air in the lumber industry are brought to mind by a booklet recently issued by the Ingersoll-Rand Company entitled "Compressed Air in the Saw Mill," which describes some of the processes and the applications of compressed air resulting in a large saving of time and money, and permitting an increased output of finished lumber to meet the demands of the building industry.

The normal production of lumber of all kinds in the United States reaches the enormous figure of 40 billion board feet per year, by far the greatest part of which is used by the building trades. Under normal conditions, about 400,000 new homes are built each year, but for the last two years, the rate dropped to 25,000; consequently, we are now short 750,000 homes, and in order to make up the shortage in five years, which is none too short a time (as all we rent-payers will agree), 550,000 new homes must be built every year. This means that lumber production must be increased during that time to at least 50,000,000,000 board feet annually.

The Northwest produces more lumber than any other region, although the South is increasing its output every year. The principal wood used is pine. Oak and redwood are also produced in large quantities. Most of the cutting is done in the winter and the logs are cut into lengths and dragged over the snow roads to the banks of the streams, from where they are sent down in the spring freshets to the sawmills below. In many regions, however, logging is carried on, the year around, by means of hastily built railroads.

On arriving at the mill, the logs await their ultimate disposition in the log pond, until taken up by a conveyor into the mill.

In the mill, the logs are cut in various ways, depending upon the size of the piece and grain of the wood. The cutting is done by band saws, which employ compressed air in a cylinder placed to keep the proper tension on the upper band wheel and for operating a small engine which raises and lowers the band shell. The logs are fed to the saws by a compressed air feed cylinder, and are turned into the proper position before cutting by a compressed-air operated device called a "dog." Steam is sometimes used for these cylinders, but the air gives more positive action. It is



Air Operated Cylinders

obvious that when steam is used in the tension cylinders, an accumulation of water results, causing considerable difficulty. With compressed air, no trouble is experienced from condensation.

The lumber is now in the form of rough boards which are often full of imperfections such as large knots, splits and similar defects. So the next step is to run the boards through a trimmer. In this device, a large number of saws spaced at regular intervals, are raised or lowered instantly by compressed air cylinders, under the control of an operator. The latter expertly judges each piece of lumber, and manipulates the saws to trim uneven ends and cut out imperfections.

Since the output of the mill is practically governed by the speed with which the lumber is handled by the trimmer, any increase in speed will represent a net gain. With the old hand power rig, the output of the trimmer is governed entirely by the speed of the trimmerman, and in large mills with this type of trimmer, the mill is often delayed by the trimmer becoming blocked, thereby tying up the whole mill. With air-operated trimmer saws, the manual labor on the part of the operator is reduced to a minimum and the capacity of the machine is so much increased that the trimmer cannot become blocked. The operating levers are small and require a very slight movement to lower a saw. On a 25-saw trimmer, the nest of levers takes up a space no more than three feet wide.

The trimmer is specially designed for operation by compressed air. The operators cage can be seen in the accompanying illustration at the right, suspended directly over the trimmer table and connected to the saws by a series of small pipes, fitted with valves which convey the compressed air to the operating cylinders. The labor involved in operating the valves is negligible and the air answers immediately to the touch. The apparatus affords an opportunity for the operator to give almost his entire attention to the lumber passing below him. This enables him to get the most out of the lumber, trimming off bad ends, cutting out specially select pieces, and grading the lumber in a scientific manner.

The lumber is now cut, but it must be seasoned, that is to say, it must be allowed to stand until the green sap in it is dried out, so it is piled up as shown in Figure 1, and allowed to stand for some time according to the nature of the wood and the use for which it is intended. The piles of seasoning woods often cover yards of large extent, and the handling is done by compressed air locomotives.

Compressed air haulage has advantages over other methods particularly where immunity from fire is of prime importance.

The modern compressed air haulage system has the additional advantages of cleanliness; freedom from breakdowns; flexibility of the system as a whole, since the locomotives are self contained all that is necessary to extend

White and Yellow Pine Lumbering in the Far West

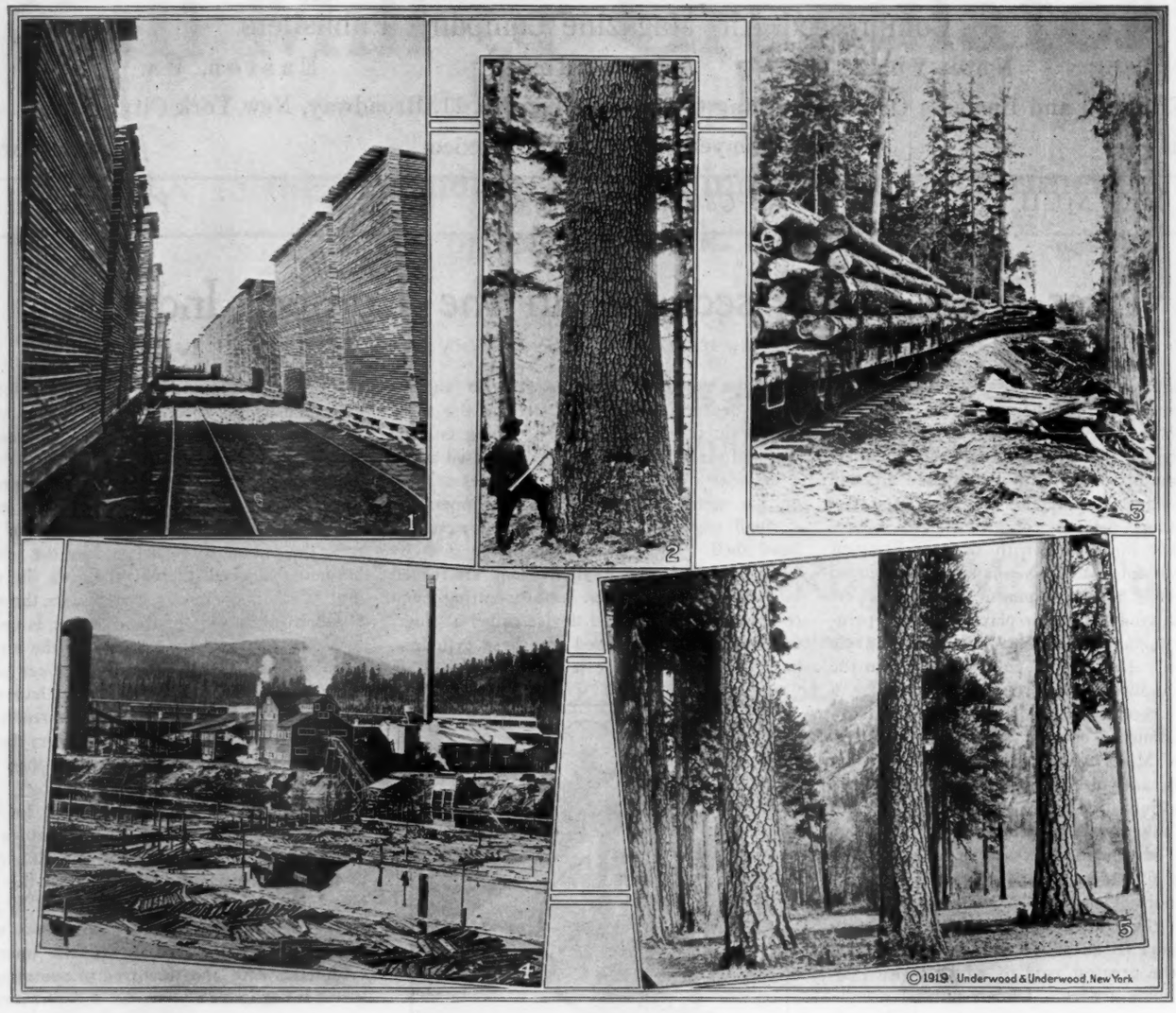


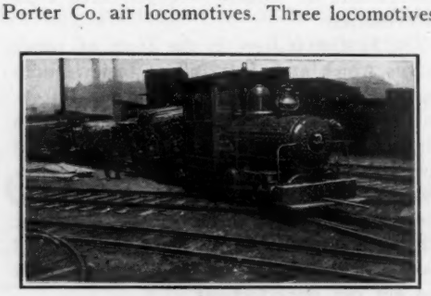
Figure 1 shows an alley in a great lumber yard at Coeur d'Alene, Idaho, the center of the lumber industry of eastern Washington and northern Idaho. Figure 2 is a magnificent sample of a stately white pine, five feet in diameter and 175 feet high. Figure 3 shows a trainload of logs on a narrow-gage road in the Idaho pine woods, near the town of Fenwood. Figure 4 shows the great mills and log pond of the Panhandle Lumber Co., at Ione, Wash., which is one of the largest and best equipped plants in the United States. It was recently the scene of I. W. W. depredations, when the Reds drove spikes into logs to ruin the saws. Figure 5 shows a glimpse of three beautiful yellow pines, near Spokane, Washington.

the system is the laying of new tracks; the fact that the air compressor, whether steam or electric driven, is located in the power house under the eye of the engineer and under conditions most favorable to efficient operation. The system is so simple that anyone can handle it and, if repairs are necessary, they can be made by an ordinary mechanic.

In lumber yards, where fuel is cheap and operating economy is not of first importance, the chief advantage to be derived from compressed air haulage can be considered as the immunity from fire risk. This results in a material reduction in insurance rates.

Compressed air locomotives of the most modern two-stage design are very simple in construction and easy to understand; have a large reserve power and a radius of action, in the various sizes, amply large enough, they are quicker and more convenient to handle than steam locomotives; they require no fireman and carry no coal or water.

The International Harvester Company, in its McCormick lumber yard, at Blue Island Avenue Chicago plant, use four H. K. Porter Co. air locomotives. Three locomotives (the fourth being kept as a spare) handle about 13,000,000 feet of lumber in twelve months, some months running as high as 13,250,000 feet. One locomotive can handle a train of ten cars, containing about 30,000 feet of lumber.

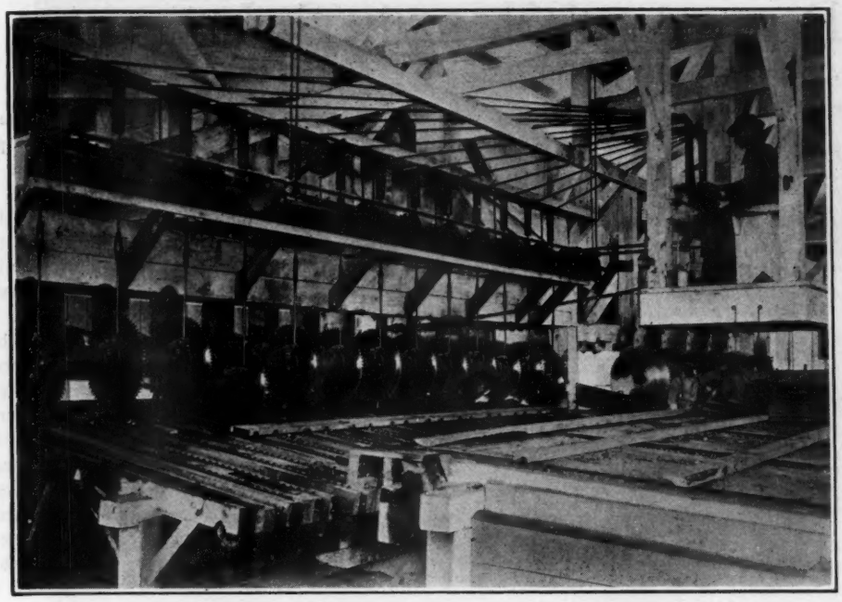


Compressed Air Locomotive

The superintendent of this plant made the statement that this equipment was giving entire satisfaction, their principle advantage being freedom from fire hazard, which is inseparable from the electrical equipment.

A simple but important use for compressed air is for blowing saw dust and shavings from the machines and for cleaning rafters, timbers and frame work. The possibility of keeping the mill free from sawdust and shavings, even in the most out of the way corners, reduces the fire hazard considerably.

For this purpose it is usually advisable to



Trimmer with Pneumatic Tripping Device

employ a self closing nozzle or "blow gun" on the end of a length of hose. This results in economy in the use of air.

The air jet is by far the most thorough and the quickest method of cleaning electric motors and generators. The importance of keeping electrical apparatus free from dust cannot be overestimated.

Nearly all up-to-date saw mills are provided with some form of sprinkler system as a safeguard against the constant menace of fire. The dry pipe system has many features to recommend it. It is simple and automatic and there is no possibility of freezing in cold weather or of corroding of the pipes and joints due to bad water.

In this system, the sprinkler pipes exposed to the possibility of freezing are kept filled with air under pressure and separated from the water supply pipes by what is known as a "dry pipe valve." In the event of a fire occurring, the moment a sprinkler head opens the air is released, allowing the water to enter the pipe and discharge from the sprinkler head, with no more than an instant's delay.

There are many devices in the saw mill, generally operated by steam, which can be operated more profitably by air. Most modern mills are using air for operating drag saws, cut-off saws, log dogs, kickers, niggers, log stops, feed cylinders, trips, transfers, and for putting the strain on upper band mill wheels.

For all these purposes compressed air has the advantages of being quicker, cleaner, more easily controlled and free from the troubles previously mentioned.

Compressed air is always more economical when used in cylinders which are only operated intermittently and even in the long feed cylinders, which are in almost constant use.

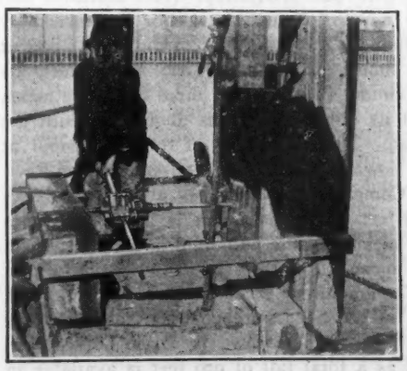
A well designed compressed air plant, particularly, if installed on the "return air" system, will result in remarkable operating economy.

Description of other air operated equipment in the lumber industry is omitted, such as that for the operation of machine tools, hoists and similar equipment, since these and similar uses are of familiar application in numerous other industries.

AIR COMPRESSORS ON STATE PILE DRIVERS

THE CALIFORNIA State Board of Harbor Commissioners have installed Westinghouse type of locomotive air compressors on each of the pile drivers which the board maintains in making repairs to the State's docks and piers along the San Francisco water front. The work of the harbor board forces has been greatly speeded up since the compressors have been installed.

Compressed air is used in operating drills for boring holes in timbers, piling and in metal. The accompanying illustration shows an air drill which was used in boring a hole through the pile driver hammer of barge driver No. 2. This work was done in about twenty minutes, and eliminated the necessity of taking the hammer to the shops, which would have been necessary had not compressed air been available.



Drilling Through Pile Driver Hammer on State Pile Driver Barge

Each driver carries long lines of hose so that work can be performed by the air drills on any part of the dock, at which the pile driver may be working. Air is used in operating air hammers for driving drift bolts through joists and in driving the four-inch spikes through the heavy flooring of the docks. Air hammers are also used in removing boiler tubes from the boilers of the pile drivers when it becomes necessary to replace tubes. It is also used in operating the appliances in setting the boiler flues. Pile driver No. 4 has just been equipped with an entire new set of boiler tubes, all work being done by compressed air, which was provided by an air compressor maintained by the harbor board for use along the water front.

MONTENEGRIN SUPPLIES SENT BY AERIAL TRAMWAY

Imagination can hardly picture a more difficult transportation problem than that presented to the American Red Cross relief workers by the difficult topography of Montenegro.

Goods are landed at the Adriatic port, Teodo, the only practicable point of entry for Montenegro. And from Teodo every pound of supplies, whether food, clothing, gasoline, typewriters, drugs, office supplies, surgical dressings, or soap for the personnel, must be loaded into trucks and hauled painfully up a sheer ascent of 4,000 feet.

Every pound must go up the Jacob's ladder of a road that makes twenty-eight hair-pin turns, where very often a five-ton truck must be backed and manoeuvred, and then loops 56 miles around naked mountain buttresses down to Red Cross headquarters at Podgoritza.

When the drift of snow was so great on the mountain passes that the most daring of trucks could not fight its way, 150 tons of supplies were swung over on the aerial tramway left by the Austrians and operated again by the Americans because Montenegro, the keystone of the Balkan problem, had to be fed and clothed and doctored. Despite these appalling difficulties, the stream of food, clothing and medical supplies from Teodo was not once interrupted.

Following a considerable slackening of production in gold and silver in Costa Rica during the war, due to lack of machinery equipment, there is now in progress a renaissance in the mining industry of that country. Prospects are bettered proportionately for the development of mineral resources as commercial conditions improve. Oil has been discovered in paying quantities and an American syndicate has a concession for exploration. The country is also said to be rich in coal and copper, both of which are undeveloped through lack of railway facilities. The Costa Rican Congress is considering the revision of unfavorable mining laws.

The Government of Ecuador, it is announced, is soon to undertake a reform of its mining statutes. A tax of from five to ten per cent will be levied on all mining properties.

Vast "White Coal" Power Available in the St. Lawrence

By ALEXANDER T. VOGELSANG

HERE is one angle on the biggest "story" in this continent today—the great international project of the United States and Canada—that of making the Great Lakes of America an American Mediterranean. Fifteen States already, by legislative or executive action, have joined hands with the Dominion in this supremely important undertaking. This year the report of the Joint International Commission will be delivered and the Congress is expected to act next December.

The First Assistant Secretary of the Interior discusses in this highly interesting paper, which he delivered before the fifteenth convention of the National Rivers and Harbors Congress at Washington, the power potentialities of the St. Lawrence in connection with this international navigation improvement which will join the Great Lakes to the Atlantic for deepsea ships drawing up to 30 feet of water. The development of approximately a million horsepower for the benefit of the State of New York, its industries, and the New York State Barge Canal, is only one phase of the most compelling transportation improvement ever brought to the attention of the peoples of North America. The entire project comprises a question not of "Shall it be done?" but one of "How soon can it be done?" Readers are invited to note the editorial in this issue, entitled, "The Sanity of Opening the Great Lakes to the Sea."

THE Department of the Interior is charged with the administration and control of publicly owned hydro-electric power sites and has, therefore, ever kept itself abreast of the development of the art wheresoever that development may have taken place, and in the beginning I wish to give due and full credit for assistance in the preparation of this paper to the magnificent annual report of the Secretary of the Interior, (Mr. Lane) just issued, and to the Geological Survey and the Bureau of Mines. Through the agencies of these bureaus, the Department is in daily touch with the power question, and out of its abundant researches and statistics I am enabled to present in outline some views which may create at least a conception in the average mind of the prime importance of power in our economic fabric. It is, indeed, the first among the present-day problems of science.

I may add at this point that more than a million men are now engaged in producing mineral fuels, the consumption of which expends and exhausts the stores of nature. On the other hand, the "white coal" of falling water is exhaustless, is everlasting. Any project that will lower transportation costs and at the same time yield energy for the use of man conforms to modern economic thought.

Dr. Steinmetz (General Electric Company) estimates the theoretical maximum of hydro-electric power of the United States at 320,000,000 horsepower, though of course but a fraction thereof can be made practically available. The Geological Survey estimates the amount practically available to be 54,000,000 continuous horsepower, and of this the boundary waters in question can produce nearly 2,000,000 horsepower, half of which belongs to us.

The Census of 1912 shows the developed water power of the United States was 4,870,000 horsepower. According to that census, the installed capacity of stationary prime movers was 30,000,000 horsepower, furnished by water, gas, and steam. This does not include power generated in locomotives, marine engines, automobiles, and such apparatus. The average power furnished by these prime movers was probably not more than twenty per cent of installed capacity so that power produced in 1912 was probably not more than 6,000,000 continuous horsepower.

Seventy per cent of the water power is west of the Mississippi, and over 70 per cent of stationary prime-movers horsepower is east of that river. Thus it is seen that the East is rapidly consuming the expendible resources of power, and that if she continues to sleep upon her water power possibilities she may soon see the transfer of many of her great industries to the enterprising, forceful, and ever-alert West.

St. Lawrence River from Tibbets Point, at the foot of Lake Ontario, to deep water at the level of Lake St. Francis at St. Regis, N. Y., flows about 113 miles along the international boundary and has a fall at low water of about 92 feet, of which about 91 feet is in the lower 48 miles, from Galop Rapids to St. Regis, there being a fall of but one foot in the 65 miles from Lake Ontario to Galop Rapids. The fall in the lower section of the river is concentrated in a number of rapids which are passed by means of canals and locks on the Canadian side. The Long Sault Rapids, with a fall of 48 feet, extend for about twelve miles along the lower end of this section.

It is only necessary to consider the immense amount of water flowing in the St. Lawrence River and its uniformity of flow to realize the tremendous amount of water power capable of being developed along the international portion of the river. The mean annual flow at the head of the river, as shown by records obtained from 1860 to 1917, is 241,000 second-feet. The effect of the Great Lakes, which act as a great system of storage reservoirs in regulating the flow in the St. Lawrence, is indicated by the fact that the maximum and minimum flow of the river differ by about 25 per cent from its mean flow. A comparison of this ratio with similar ratios for the Ohio and Mississippi rivers indicates that the flow of the St. Lawrence is remarkably uniform. The mean flow of the Ohio River at its mouth is about 300,000 second-feet, its maximum flow is about three times the mean, and its minimum flow is about one-tenth the mean. The mean flow of the Mississippi at the power plant of the Mississippi River Power Company at Keokuk is about 50,000 second-feet. The maximum is about six times the mean and the minimum is about one-fifth the mean.

The amount of theoretical power per foot of fall in the St. Lawrence River, as shown by the mean annual flow, is 27,360 horsepower, and as a total fall of 920 feet is available in the international section of the river the theoretical power in that section is about 2,520,000 horsepower. Assuming that only 70 per cent of this energy can be made available on account of losses in head and inefficiencies of water wheels and generating equipment, this stretch of the river, owned equally by the United States and Canada, would furnish 1,764,000 horsepower, or 882,000 horsepower to each.

About 95,000 horsepower of the portion belonging to the United States has already been developed by the St. Lawrence River Power Company by means of a canal which diverts a maximum of 30,000 second-feet from the river near the head of the Long Sault Rapids through the power house into Grass River, which joins the St. Lawrence below the Long Sault Rapids. Here a head of about 40 feet is developed. After the power utilized at this development is deducted from the power of the portion belonging to the United States the power not yet developed in that portion of the river amounts to about 790,000 horsepower.

As a horsepower is practically three-fourths of a kilowatt, 790,000 horsepower is equivalent to about 590,000 kilowatts. This amount of power is about one-third the total installed generating capacity of all the plants engaged in producing electricity for public use in New York State, slightly more than the installed capacity of generators of similar plants in the State of Michigan, and about 75 per cent of the capacity of those in Massachusetts. In only six states in the United States does the total installed capacity of electric generators in public utility plants exceed 590,000 kilowatts.

If the development were so made that a certain amount of regulation of stream flow by storage in Lake Ontario were possible and if load conditions were adapted to the full utilization of all the power produced, it would appear that the share of the United States of the St. Lawrence River power would be about 425,000,000 kilowatt-hours per month. The amount of power produced from fuels in public utility plants during the month of February, 1919, in New England and New York State was about 460,000,000 kilowatt-hours. The amount of power so produced from fuels during that month in the central New York region, from Albany to Buffalo, was only about 30,000,000 kilowatt-hours, so that if any considerable portion of the St. Lawrence River power were to be marketed for use by public utilities it would have to be transmitted to the metropolitan district of New York, a distance of about 350 miles. Here there is now produced from fuel at least 300,000,000 kilowatt-hours per month. Much of New England is within a transmission distance of 250 miles and requires about 150,000,000 kilowatt-hours of fuel-produced energy monthly for public service alone.

The industrial plants not supplied by public service companies use a large additional

Alexander T. Vogelsang, First Assistant Secretary of the Interior, at his desk in Washington

but unknown quantity of energy. The transmission of these quantities of power over the distances indicated is unprecedented but is not to be regarded as unattainable in the present state of high-tension operation. In view of these requirements, there can be no reasonable doubt in anyone's mind that there would be an ample market for all the power that can be developed on the St. Lawrence. The annual value of our horsepower would be about $12,000,000, and figured on a five per cent basis would show a capital value of $240,000,000.

The utilization of this power in public service to replace coal now consumed in the large manufacturing centres of New York and New England has an important bearing on the extension of the life of our coal deposits. On the basis of three pounds of coal per kilowatt-hour, this St. Lawrence River power is the equivalent of about 7,750,000 tons of coal annually. This is about 1.3 per cent of the total production of bituminous coal in the United States in 1918. The amount of coal consumed per year by public utility plants in New England and New York is only about 7,000,000 tons.

The power possibilities of the St. Lawrence have therefore very large economic importance, and any plans for developing the river for navigation should make provision for the maximum development of the energy that it will afford. This provision can be made only by working out a comprehensive plan in which both Canada and the United States seek the best engineering and economic solution of the problem. No doubt private capital is available to make all this improvement in consideration of a grant of the power privilege, but there is equally no doubt that this will not be done. Canada as well as the United States would not permit it.

About 55 percent of the world's coal is in the United States. We must some day become great as a coal exporting nation. In the pre-war period we sold abroad only 4,500,000 tons of our annual production of 700,000,000 tons, which Secretary Lane visualizes in his report by stating that this amount of coal would build a Chinese wall along the outboundaries of the United States from Maine to Vancouver, to San Diego, and eastward to Maine again. England exported 77,000,000 tons. In fact, England's primacy in commerce is due to her coal exports, which afforded cargo to her merchant fleet and gave her bunkering facilities all over the globe.

She can no longer maintain this figure of exportation for many reasons, and is even now asking us for coal. Continental Europe freezes today, and will probably henceforth be forced to large purchases from us. Indeed, her prayers to us today are as fervent for fuel as they are for food and credit. We must also henceforth largely supply the South American market. It is easily imaginable that clearing this waterway to navigation will release for export millions of tons of coal from the central fields and thus stabilize labor and general mining conditions, giving to the mineworker what today he craves most—more days of work per year—with necessarily resulting benefit to the mine owner and operator as well.

The railroads, indeed, should be relieved as much as possible of the carriage of coal. It is the largest single item of railroad freight. Hydro-electric power and power generated by coal at the mouth of the mine will in no distant day not only avoid the great haulage of this low-grade freight, but will propel the trains themselves which will carry the high-value product of looms and factories that also are driven by electric power. We may indulge the high conception that one day this great coal-producing nation will operate her mills, her mines, her railroads, by electric power and ship a vast mass of her coal production by water route almost from mine to foreign market.

Regarding transportation, I venture this question: Where would our iron industry be

today were it not for the cheap water transportation enjoyed by four-fifths of out total iron ore production tributory to the Great Lakes? That waterway, and not that iron, is the foundation of our position as the world"s greatest producer of iron and steel. This is a fair illustration of the claims made by the proponents of this improvement, that transportation governs production. Indeed, obstructions to navigation are obstructions to commerce and obstructions to production. The removal of the first enhances the others. High cost of freight rates promotes high cost of living and puts production on the "red," and when production goes upon the red it is evidence that it has bled to death.

Recurring again to the power possibilities of the St. Lawrence, I venture to say that it is readily perceptible to anyone that of all the states bordering or tributory to this water way the greatest beneficiary of the development will be the great and Empire State of New York. The letting loose of this flood of power over her territory will cause her to leap to the front as a manufacturing State, and her products so stimulated by cheap power will find market in all the countries of the world. With her magnificent harbor and the superb advantage of her barge canal affording cheap water transportation thereto, and at the same time enjoying and possessing all the benefits of the St. Lawrence route, hundreds of miles nearer salt water than her western competitors, her high-value manufactures will have a permanent primacy over any other State of the Union.

Indeed, it is no idle dream to picture her barge canal and her lake shore dotted with factories of all kinds in enjoyment of this white coal at low rates in operation 365 days in the year, independent of season, their power coming into the factory on a wire instead of by rail and upon cars, free from labor, climatic, or transportation trouble or interruption. No other State of our Union has the same strategic advantage in power, population, labor supply, and transportation, and these advantages for natural and geographical reasons can probably never be lost; and this notwithstanding that the day is coming when the West will hold most of the black coal reserves of the country in addition to her everlasting majority of the white-coal supply.

Quicksilver output of United States for third quarter of 1919, according to U. S. Geological Survey was 5,225 flasks of 75 pounds each, an increase of 1,285 flasks or 32 per cent compared with second quarter. Total production in 1918 was 32,883 flasks. Output, first three quarters of 1919 totals 17,758 flasks.

Outlook is that quicksilver output of the year will not exceed 20,000 flasks. Quicksilver on hand at mines or in transit to market September 30 amounted to 2,185 flasks compared with 1,635 at end of second and 2,800 flasks at end of first quarter. Quicksilver exports from the United States during October totaled 38,523 pounds valued at $42,921, Hongkong taking 15,820 and Japan 15,800 pounds.

Wide Variety of Uses for Oxygen in War Times

By MAJOR J. M. MOREHEAD

THE MANY and diverse uses of oxygen during the war, covering anything from the manufacture of poison gas to providing the necessary quantity of this element for explosive mixtures in airplane engines in the rarified atmosphere of high altitudes, as well as its use for supporting human life in submerged submarines, indicates strongly the essential nature of the element in modern warfare. We are indebted to Major Morehead for his paper on the subject prepared for the annual convention of the Intersectional Acetylene Association.

I HAVE gotten up on this occasion to tell you how good oxygen is, how much better it is than acetylene, and how much more essential, or equally—because there is no place where you can use acetylene that you do not have to have oxygen, but there are a lot of places where you can use oxygen that you don't have to use acetylene.

In this oxy-acetylene business the oxygen is like the bridegroom at a wedding, he gets some consideration because he is essential, but the bride is the one thing your hear about. The bridegroom endows the bride with all his wordly goods and all that, and all she does is to promise to love, to honor, and to obey, and after awhile she changes that to stop, look and listen. In oxy-acetylene welding there is from one to two times as much oxygen used as there is acetylene, and the oxygen costs twice as much.

What I am here for is to tell you how good oxygen is, without acetylene, and the uses they made of it in war.

We used a great deal of synthetic ammonia during the war, at least we got ready to make a lot of synthetic ammonia. The air consists of twenty per cent oxygen and 80 per cent nitrogen. The minimum is 50-50, and you get a much higher efficiency in the matter of atmospheric nitrogen if you get a 50-50 mixture to start with.

All of the plants which were making synthetic ammonia had oxygen plants to strengthen the oxygen in the air, and they got a much higher efficiency in that way. The oxygen was used in the army departments in the medical bureaus in anaesthesia—they mixed it with chloroform or ether, and that lent a great deal of value to the regular anaesthesia, which was practically the only treatment used for gas attacks. When a man was gassed the only thing that would keep him alive until nature could come to his rescue and throw off some of the temporary effects, was to give him oxygen, and they kept a lot of oxygen in balloons or small bags, and that was the first treatment that men who were gassed received.

In the matter of the manufacture of phosgene, which is used in the manufacture of all poison gases, they used carbon monoxide, and for the manufacture of the carbon monoxide they used carbon dioxide and oxygen mixed in the proper proportions. and the mixture blown through a coke or coal fire. The oxygen reduces the dioxide and produces monoxide. In this way you will see that the oxygen was the basis of the phosgene which is used in making poison gases. They used oxygen in the manufacture of phosgene to make a man smother to death, and they used it for bringing him back, after knocking him out.

Of course, on all of things and apparatus used in this production of oxygen, there was a great deal of welding, but I am speaking of the uses of oxygen for purposes other than welding.

All of the airplanes carried cylinders of oxygen with them, they would get so high and the air would become so rare that the pilots and observers suffered great distress for want of air which they could breathe. They had a sort of gas mask and they took a small cylinder of oxygen with them, and by breathing this oxygen they were able to function just the same as if they were on the lower levels in the air in which they were accustomed to exist.

It is a peculiar thing, which is not very well understood, but susceptible of very simple explanation, that a gas engine will give you practically the same amount of power, irrespective of fuel. You can use a fuel with a high heat unit content, or a low heat unit content, and get about the same power out of it, and the only way in which you can materially increase the power of gas engines is to substitute oxygen for air, and in that way you will get a higher percentage of explosive mixture in the cylinders—and when these engines would get so high in the space above the clouds that they did not have enough air from the carburetor to the engine, they had an arrangement on the recent airplanes for supplying oxygen. There is no difference between compressing the air and using twice as much gas, and putting twice as much oxygen in.

Submarines all carried a large amount of oxygen, for the purposes of use by the crew in respiration. When they were forced to stay under the surface of the water for a great while, they would freshen up the air, which they had to use over and over again, first by scrubbing the carbon dioxide out of it, and secondly, by adding a large amount of oxygen, and that enabled them to stay down without dying.

I understood that the Germans equipped submarines with net arrangements operated by oxy-acetylene under water. They would take an ordinary oxy-acetylene torch and surround it with a big jet of compressed air and blow the water away from where the net was, and then they could use the oxy-acetylene blow pipe. I do not know whether that was ever done on our submarines or not.

A design of submarine was gotten out by which the submarine engine could be run under water. A submarine as generally consrtucted is equipped with a gas engine, and with a lot of storage batteries and with a motor. When they are submerged they have to use the motor, because they cannot run the engine; in the first place they have not the air, and in the second place they canot get rid

of the exhaust. There was some design in which the electrical equipment and the storage batteries were dispensed with and they carried a large amount of compressed oxygen. When the submarine was under water they operated the motor with oxygen, and forced the exhaust out through the shell of the submarine, and in that way they were able to run under water with the engine at quite high speed, and some of this type of submarines were being built, although I do not think any of them were finished when the armistice was signed.

I had occasion to go on a German submarine, since the war was over, that was up in the Sound, in connection with the Liberty Loan, and I was surprised to see the tremendous amount of welding on it—all valve walls were welded—it was really surprising to see the amount of welding that was done. The valves were spidered out and stamped and ringed out, and there was a welded ring on the valve walls running all the way from three inches up to 30 inches across.

The Motor Transport Corps used a large amount of oxygen for repairs and construction and for burning out carbon. In the steel companies they were driving the furnaces so fast in a lot of cases that the jet holes would become stopped up, and they used an enormous amount of oxygen in volume for burning out the jet holes and clearing out the places where the holes would freeze up. If you had enough iron, red hot to start with, you could burn out the iron and melt out the fire clay and burn a hole through, and many times they were able to keep their furnaces going simply because they were enabled to use oxygen in making repairs.

A man in the Fisheries Department, while I was in Washington, told me they were using oxygen in transporting live fish, where they sent fish out for stocking purposes. A fish, although it lives in the water, breathes air; it breathes the air absorbed in the water, and by the use of oxygen, instead of depending on a large surface of water; so that the water can absorb the air for the fish to breathe, they keep the oxygen bubbling through the water, and they can keep more fish alive in a tank of water by using the oxygen than they can by using the air.

There were a number of processes for roasting ores and tempering steel, in which oxygen was used. The steel people, in making their guns, found that they could get a much higher heat by burning oxygen in the fuel, whatever it was, say coke, than they could by blowing it with air. For doing heavy work of that sort they saved a great deal of time by heating up these salamanders or heating furnaces with oxygen, and a lot of it was used for that purpose.

In ore roasting there are several processes in use by which you can just about get by with the use of air—you can get your temperature, and if everything goes exactly right you can roast your ore; but if it does not go exactly right you find you have not quite temperature enough—and there is a firm in St. Louis that raises the temperature very considerably by putting in an extra few per cent, not exceeding five, of oxygen in the air with which they blow the furnaces.

One of the big uses we found for oxygen was in making shells, especially for the heavy work. The steel came in big square bars, or sometimes round, and the first job was to cut it up into lengths for the separate shells. This was originally done by a powerful shear, and the ends would not be square, so that when fastened to the faceplate they would wobble so that it was impossible to use them. Then we cut them off with the acetylene torch and they were all right.

When we started in the war the amount of oxygen on hand was adequate for the uses of the country, but when the uses increased so enormously with the war demands, there was not enough oxygen to meet the demands. All of the oxygen people came to the help of the Government, the amount of oxygen produced was increased many fold, and then the cylinders were the restricting detail. A foot of oxygen does not do any good unless you have a pound of steel to hold it in. There were only three cylinder manufacturing concerns in the United States and the Government took one of these to make trench mortars, and took many cylinders for hydrogen and sent them abroad, so that that made a great shortage in the supply of cylinders to hold the oxygen.

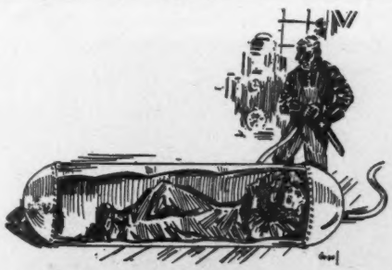
We called a meeting of the oxygen people in Washington, and among other things we adopted a tag to go on each cylinder, which read, "This cylinder is needed in war work," and we appealed to the patriotism of the people to return them promptly. It had a wonderful effect. The cylinders which before the war would take from six to eight weeks before they were returned would come back in about three weeks.

SOLUTION OF THE PROBLEM

By JOHN R. GODFREY

[In the *American Machinist*]

The designer, whom we'll call Jackson because that wasn't his name, was a good sort, but he was shy on shop practice and sometimes slipped a cog or two on that account. Orders came for a lot of air tanks, about 30 inches in diameter and eight feet long, and Jackson got the drawings out in a hurry.



It wasn't long before the head boilermaker came into the office, and Jackson asked him how soon they could begin turning out some of the tanks.

"That's what I came to see you about, Mr. Jackson. I can make six of those tanks in short order, but that's all. Can't make any more unless I get a new crop of boilermakers."

"What d'ye mean, Baxter—new crop of boilermakers—why can't you make the whole lot with the men you have as well as to make only six? Quit your joking and go get busy."

"Well, you see, Mr. Jackson, that blueprint calls for hemispherical heads on both ends. They've got to be riveted up with a man inside. Now I've only got six men to put inside for the holders-on. When they are riveted up inside, I'm done—see.

"Now, if you'll just change that design so one head bulges in—so the second head can be riveted from the outside—I can get the whole lot out in short order."

And he left the blueprint on Jackson's desk, dodged an ink well as he went out, and went to the purchasing agent to order the material.

HERBERT HOOVER TO HEAD ENGINEERING SOCIETY

HERBERT HOOVER, the engineer who so ably personifies the definition of engineering as written on the wall of the Engineers Library, New York, "Engineering, the art of organizing and directing men, and controlling forces and materials of nature for the benefit of the human race," is to be the next president of the American Institute of Mining and Metallurgical Engineers.

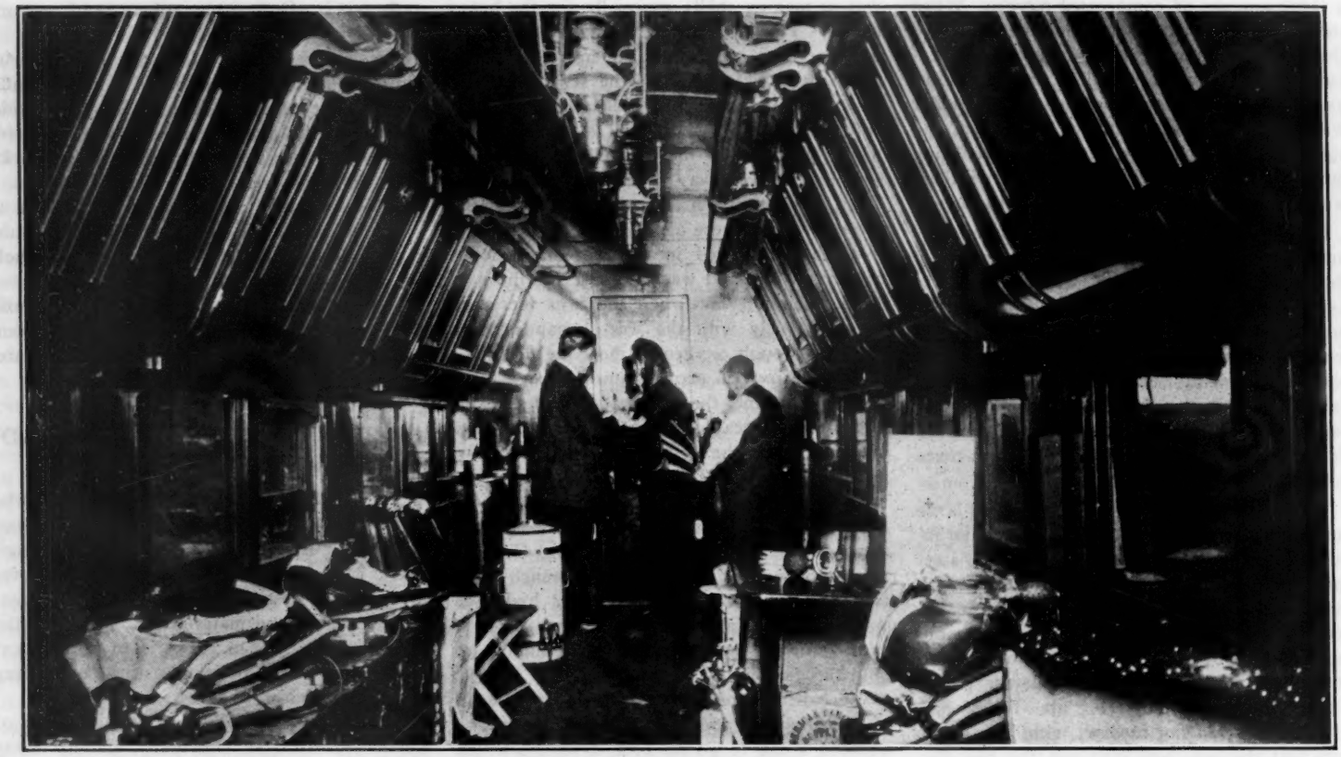
Mr. Hoover is a graduate mining engineer of Leland Stanford Jr. University, and for many years was engaged as consulting and managing engineer in metallurgical, mining and railway operations in Mexico, Russia, Africa and India. He took part in the defense of Tientsin during the Boxer disturbance in 1900.

When the war broke out in 1914, he organized the Commission for Relief in Belgium and under his supervision millions of people were saved from starvation. After America entered the war, Mr. Hoover was placed in charge of the food situation in the United States and since the signing of the armistice he served as director general of the American Relief Administration, director general of Allied Relief, chairman of the Food Section of Supreme Economic Council of Peace Conference, member of the War Trade Board and numerous other official bodies.

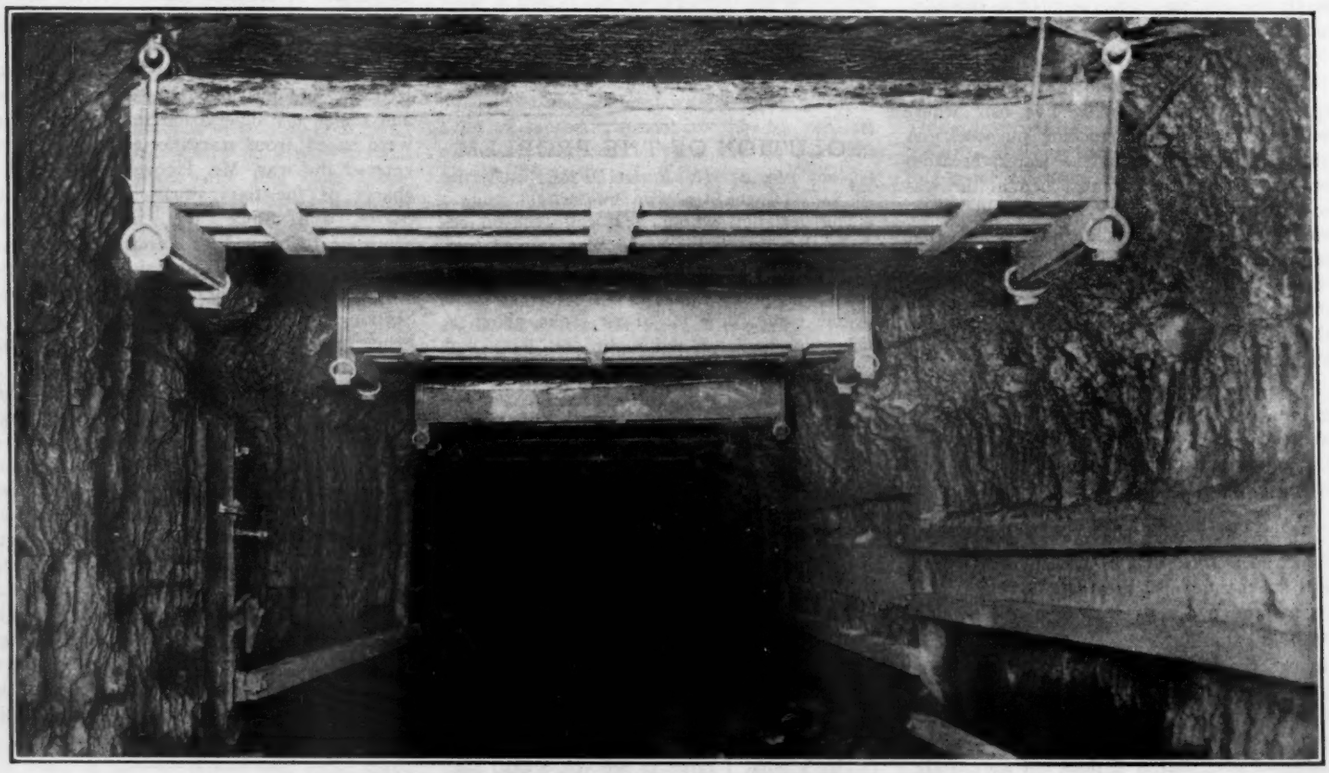
Mr. Hoover's record both in private and public life mark him as one of the greatest executives in the world. His knowledge of international affairs gained from the administration of his financial and engineering enterprises, which he always developed under his own personal supervision, and in his official capacity during the war has given Mr. Hoover a wide and intimate appreciation of the problems of the present reconstruction period. The Institute is to be congratulated upon its choice. Likewise, Mr. Hoover in this representative national organization will be provided with the machinery for utilizing his vast experience and producing results of great benefit.

A Swedish scientist has produced a flame with a higher temperature than that of oxy-acetylene and has also devised a burner employing powdered aluminum and oxygen.

Rescue and Safety Measures of the Bureau of Mines



Interior of one of the eleven mine-rescue cars of the U. S. Bureau of Mines. These cars are located in the principal coal fields in the country, and respond to calls for help at mine disasters.



The long boxes suspended from the ceiling in this mine are rock dust barriers, which prevent the further propagation of an explosion. The force of the explosion will shatter the boxes, scattering the stone dust contained therein in a cloud. The stone dust being inert fails to feed the flames like the carbon in coal dust and the explosion dies. These barriers were designed by George S. Rice, Chief Mining Engineer of the U. S. Bureau of Mines.

Industrial Exhibition at Scranton, Anthracite Metropolis

By EUGENE P. McCRORKEN

SCRANTON'S FIRST industrial exposition in three years was held the first week of December at the 13th Regiment Armory in that city. The exposition was held under the auspices of the Scranton Board of Trade, of which E. L. Merriman is president, and Mark Edgar, the secretary. Exhibitors included machinery companies, patriotic societies, technical and trade schools, financial institutions, automobile and hunting clubs and similar bodies.

It was unfortunate that the coal industry, which in former years had been portrayed to visitors by means of working models of underground scenes and mining operations taken from real life, was unrepresented. Similarly the silk industry was also absent. In previous expositions, the coal industry had always occupied a premier position and made it known that in estimating Scranton's commercial importance, coal production ranked as a factor of the foremost significance.

Scranton declares itself to be the greatest anthracite coal mining city on earth, and it can substantiate this assertion with statistics. The city has a population of 148,000, but nearly 400,000 persons live within a ten-mile radius. The value of the coal mined in this area amounts to more than $46,000,000 at the mine per year. The 20,000,000 tons produced annually provide the energy for a considerable part of the nation's industries and for the comfort of a great part of the population in other cities.

Scranton is especially favored as a transportation centre, being served by six railroads: the Delaware, Lackawanna & Western, the Central Railroad of New Jersey, the Delaware & Hudson, the New York, Ontario & Western, the Erie and the Lackawanna & Wyoming Valley.

However, Scranton does other things than mine coal. Its industries produce a varied assortment of mining machinery including breaker rolls, screens, mine pumps, grates, blowers and hoisting engines. It has great plants devoted to the manufacture of cotton, woolen and muslin underwear, and lace curtains, and it ranks next to Paterson, N. J., in the magnitude of its silk industries.

It is also the home of the International Correspondence Schools—the largest educational institution in the world, by mail—and one of the world's greatest technical publishers.

This organization was founded 28 years ago and has registered more than 2,000,000 students, residing throughout the world. A visit to the headquarters of this institution and an inspection of the editorial, advertising, printing and bookbinding departments is a revelation. The multiplicity of printing machines, cutters, bookbinders, multigraphs, pamphlets sewing machines and many other unclassified pieces of mechanism for performing special operations is nothing short of bewildering to the uninitiated. A new building with an open court yard in the center, which will house the administrative, editorial, advertising and circulation departments is to be constructed in the near future in order to meet the pressure being placed upon the present equipment by the enrollment of between 10,000 to 11,000 new students monthly.

The following interesting items give some idea of the work performed by its personnel. Over 40,000 pieces of mail are handled daily. Advertisements are published in an almost incredible number of magazines and technical and trade journals. Illustrated advertising circulars are distributed to the number of 60,000 each day in homes and offices by I. C. S. representatives. Each day 2,800 to 3,500 inquiries are received in reply to advertisements. The instruction department examines and corrects 3,000 lesson papers and 400 drawing plates daily.

In the course of the recent strike in the printing trades, the company undertook successfully to print several of the popular monthly magazines, which illustrated the flexibility of its printing department to expand output according to existing circumstances. As an instance of this, a single order for 300,000 text books for school districts of a southern state was accepted and completed within the time alloted in the contract.

Among the machinery manufacturing companies with exhibits of their products in booths at the Armory were the Ingersoll-Rand Company, the A. S. Cameron Steam Pump Works, the Scranton Bolt & Nut Co., the Scranton Pump Co., the National Marine Engine Works and the E. I. Du Pont de Nemours Co.

It was said by old-time miners in the early days of the West that the first two men following upon the heels of the prospector, who had struck "pay dirt" were the commercial representatives of the Du Pont and Ingersoll-Rand companies, and the presence of their exhibits at the Scranton exposition indicated a consistent policy of industrial enterprise and service.

The Du Pont company had installed a striking exhibition of two great eight-foot revolving rolls rotating in an annular receptacle performing the operation of grinding black powder to its proper degree of fineness.

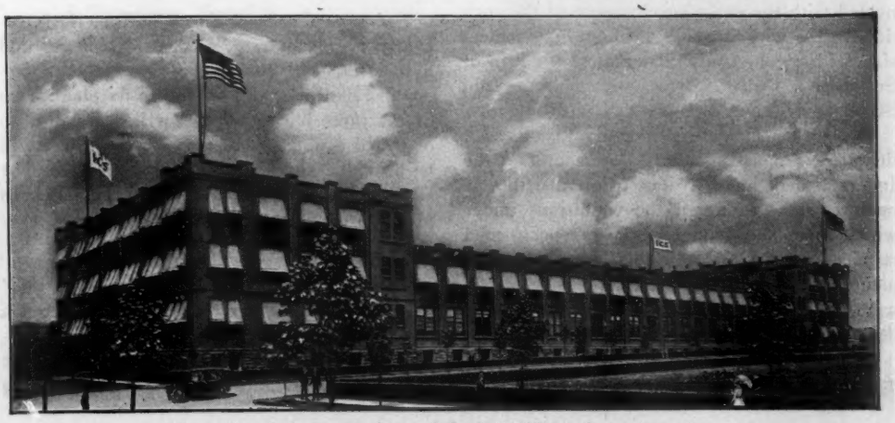
The Ingersoll-Rand Company had an exhibit of air compressing machinery including "Jackhamer" drills in various sizes, drill sharpeners, Cameron pumps, "Little Tugger" hoists, a vertical air compressor and specimens of "Little David" pneumatic tools, among which were chipping and riveting hammers and coal picks.

The display also contained an element of historical interest as the several stages in the development of the modern efficient rock drill were illustrated by some of the earlier types, now obsolete. Of particular interest was an old type of the Leyner drill, first invented by J. George Leyner in Colorado in 1897. This invention, which marked an epoch in the design of rock drills and revolutionzed the drilling practise of that time, was discussed in detail in an article, *Development of the Rock Drill in America—Past and Present,* by Charles Austin Hirschberg in the December issue of COMPRESSED AIR MAGAZINE. As stated therein, the license rights to the Leyner drill were afterward purchased by the Ingersoll-Rand Company. Since then many modifications and refinements have been made, as typified in the Leyner-Ingersoll drill.

U. S. SELLS GENERATOR SETS

The Director of Sales announces that the Surplus Property Division, Office of the Quartermaster General of the U. S. Army, is offering for sale 400 gasoline driven, electric generator sets, with switchboards and gasoline tanks, which have been declared surplus by the War Department and on which offers will be received at any time by the Surplus Property Division, Munitions Building, Washington, D. C.

The generator is a 25 kilowatt, direct current commutating pole type. Either 115 volt, two wire, or 230 volt, three wire, generators can be supplied. The engine is of the closed, four cycle, single acting, vertical type, with four cylinders and is capable of operating the generator at full load indefinitely and at a 25 per cent overload for two hours. The sets are located at Schenectady, N. Y., and New Cumberland, Pa., and will be shipped promptly upon approval of submitted offers. Inspection of the equipment may be made at the points of storage.



International Correspondence School Building, Scranton, Pa.

Making Dust Explosions for the Movies

AN ACTIVE campaign against grain dust explosions is being promoted by the United States Department of Agriculture in cooperation with the United States Grain Corporation. Arrangements were made for the production of a series of motion pictures at the Pittsburgh experimental station of the Bureau of Mines. Taking close-up pictures of experimental explosions so unexpectedly violent that they knocked down spectators standing at supposedly safe distances, and practically wrecking the steel and concrete structure especially designed to withstand blasts of this sort, made a thrilling experience for the photographer employed.

Nothing so violent and destructive as the detonations which occurred during the demonstration were looked for by the engineers present, who frequently had set off charges in the same plant in connection with the study of mine-explosions. The experiments offered overwhelming evidence of the terrific force of blasts due to flour and starch dust, and enabled those witnessing them to appreciate more vividly than ever before the penalty that often is exacted for carelessness in allowing dust to accumulate in plants.

Special apparatus was used by the investigators to register the relative violence of the different explosions. While additional research will be necessary to give the data their fullest scientific value, the results of these first trials showed that the dusts used produced explosions far more violent than was anticipated.

The special programme devoted to work against grain-dust explosions in which the films are to be featured, is being arranged for in principal cities of the country. They illustrate, more graphically than lectures or statistics can possibly do, the need of taking thorough precautions against grain dust in elevators and other grain-handling plants.

The apparatus used as a setting for the movie views, the taking of which involved so much unexpected adventure, consists of a steel cylinder or gallery 225 feet in length, set above ground, which serves as a counterpart of a mine gallery. In the upper surface of the cylinder, at stated intervals, are ports, some of which are provided with lids. The progress of an explosion from one end of the cylinder to the other can be detected by jets of smoke and flame that burst from one after another of these vents. The motion pictures secured show this interesting phenomenon clearly. Shelves arranged laterally inside the tube were sprinkled with flour for one of the demonstrations, and with a starch dust for another.

One end of the cylinder is open while the other is closed, except for a small aperature against which the mouth of a specially designed so-called "cannon" is placed. This was used to start the explosion, the setting off of a small charge of gunpowder throwing the dust into suspension and igniting it.

As a preliminary test, the engineers in charge exploded coal dust which made a detonation that seemed violent, indeed, to the novice, but was not considered unusual by the experts present. After the cylinder had been cleaned and "loaded" with flour dust, such as is too prevalent in carelessly operated mills, this second charge was set off. The blast was far more violent than the one preceding it and startled the engineers. However, it was mild compared with the third and last explosion, produced by substituting starch dust for the flour dust.

During each of the experiments the motion-picture operator was housed in a portable telephone booth brought to the scene to serve as a shelter and placed with the solid board side of the booth turned toward the mouth of the cylinder. This shelter was set less than 100 feet from the cylinder, and just enough to one side to be out of the direct line of the blast. A hole was cut in the wall of the booth through which the camera was trained on the scene of the explosion.

During each of the first two blasts the operator was somewhat shaken by the detonation, but the shocks were relatively light and their effects little more than temporary. With the setting off of the starch charge, however, the earth seemed to tremble, the booth rocked on its foundation, and reports received later showed that houses two and three miles away were shaken. The concussion shattered the glass in the walls of the telephone booth. The operator was temporarily blinded and almost stunned, but his long training in his profession kept him turning the crank of his camera even as it swayed to and fro in its shelter. All of this upheaval took but an instant of time. Climbing out from the damaged booth the operator looked about and found that some of the engineers, who had stood at a considerable distance to witness the test, had been thrown to the ground. As soon as they recovered their senses and equilibrium they ran to the telephone booth fearing that the operator had been killed.

While no one received serious injuries, the experiment was one which no one is anxious to go through a second time. Examination of the Bureau of Mines' equipment showed that the concrete foundations had been shattered by the violence of the blast and part of the shelves within had been blown out and reduced to kindling, while the target or deflecting screen, which stood some distance from the open mouth of the cylinder, had been partly torn from its deeply laid foundations. Motion picture men state that, in the whole history of the industry, few movie views of this sort have been taken under such hazardous circumstances.

DEATH OF GEORGE RHODES CULLINGWORTH

George Rhodes Cullingworth died in December last at the ripe age of 82 years, although his friends and associates had little idea he had reached these years, so well did he carry them. Mr. Cullingworth was connected with the early development of the rock drill in the United States through his partnership with Henry Clark Sergeant in the firm of Sergeant & Cullingworth with shops at 22nd Street and Second Avenue, New York, in 1870.

This firm commenced manufacturing rock drills for Simon Ingersoll, the inventor of the Ingersoll drill in 1871. The original drill was operated by steam, but the conditions under which mine and tunnel work was performed required the use of air. This led to improvements in the design of air compressors which were effected in the shops of the company under the direction of Mr. Sergeant.

In 1887, Mr. Cullingworth sold out his interest to Mr. Robert W. Chapin, the new company becoming known as the Ingersoll-Sergeant Drill Company. Shortly afterward, Mr. Cullingworth became connected with the Garvin Machine Co., in New York, of which he was vice-president at the time of his death.

The Wharton Steel Co., Wharton, N. J., recently acquired by J. Leonard Replogle and associates, will spend approximately $1,500,000 in rebuilding and adding to its plant. Two of the three blast furnaces will be rebuilt, an ore yard equipped with an electric bridge will be provided and stock bins reconstructed. The engineering and construction contract has been placed with Arthur G. McKee & Co., Cleveland.

The Brazilian Government has registered a contract with its *Tribunal de Contes* permitting the laying of an All-America cable line from Rio de Janeiro to Cuba and providing direct communication with the United States. The Central & South American Cable Company states that every effort will be made to lay and operate the new line at the earliest possible date. Shipment of the cable from England is soon to be made.

Fairbanks, Morse & Co. are to erect a foundry in Beloit, Wis., this year, which will be 900 feet long by 550 feet wide, and which will contain 495,000 square feet of floor space. This structure, including storage space for flasks, iron, sand, and similar materials, will cover eleven acres. The ultimate output will be 350 to 400 tons of gray iron daily and will require an additional 3,000 men. The new plant will be equipped with electric cranes and grab buckets for carrying moulding and core sand and coke, while electric magnets will grip the pig iron and remove it from the cars. A complete ventilation system, hot and cold shower baths and a modern cafeteria are other features included in the plans.

Practical Applications of Air Conditioning

By J. ESTEN BOLLING*

AIR CONDITIONING is the science of feeding air so as to automatically and accurately control its temperature, its humidity, its purity and its effective distribution.

In the more than two hundred different industries which we have served, comprising more than a thousand separate installations, we have proven that air is an essential manufacturing consideration. Sometimes it is a matter of process control, like drying, control of moisture regain, maintenance of high or low temperatures and corresponding humidities, and, sometimes, it is a question of labor control. This has been particularly true in the textile industry where we can ordinarily effect from ten to twenty degrees cooling by utilizing the evaporative depression only. This has proven a wonderful arbitrator of labor disputes. In some localities, unequipped mills have been forced to shut down because of labor difficulties, while mills equipped with air conditionnig apparatus (as distinguished from ordinary "humidifying apparatus") have been besieged with operatives wanting work.

The purpose of this paper is to give you a short story of air conditioning and a few of its industrial applications.

Fig. 1 shows a typical humidifier. The air to be conditioned is either drawn or blown through the humidifier by means of a fan. The air first passes through a distributing plate which breaks up the strata and produces a uniform velocity over the entire cross-section of the moving column. It then passes into the mist chamber where it is brought into intimate contact with a finely divided water spray. (A brine spray is used for dehumidification, where the spray temperature is below the freezing point, and other liquids can be used when necessary). The spray is produced by pumping the liquid through a tangential spray nozzle at a pressure of about fifteen pounds, usually. A simple centrifugal pump is used and the spray which is collected in the tank at the base of the humidifier, is strained before admission to the pump inlet, for recirculation. Make-up spray liquid is added automatically by means of a float valve.

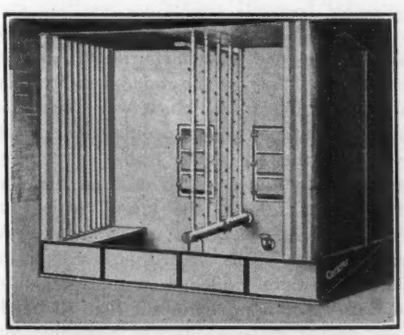


Figure 1—Typical Carrier humidifier

The air in contact with the mist becomes saturated with water vapor at a temperature dependent upon the temperature of the spray. Humidification or the addition of moisture to the air, is performed by heating the spray above the normal temperature of the entering air, and dehumidification, or the removal of moisture from the air, is accomplished by means of cooling the spray below the normal temperature of the entering air. In either case the air leaves the machine saturated at a given temperature, and its absolute humidity is therefore definitely controlled by controlling the temperature of the spray. In humidifying, the temperature of the spray is controlled by placing a thermostat in the mist chamber of the humidifier and arranging the instrument to act upon either an ejector or closed heater, or upon a three-way mixing valve, as may be required. In dehumidifying the temperature of the spray is controlled from a similar thermostat acting to govern a three-way brine or cold water mixing valve. Cold well-water is used where available and mechanical refrigeration is used elsewhere, the ammonia being used to cool the spray liquid. In the smaller, self-contained types of dehumidifiers the cooling chamber is placed directly below the mist chamber, as an integral part of the machine. The spray liquid is cooled by flowing over Baudelot coils, as shown in Fig. 2. In the larger dehumidifying installations the spray liquid is cooled in shell-and-tube type coolers, Fig. 3.

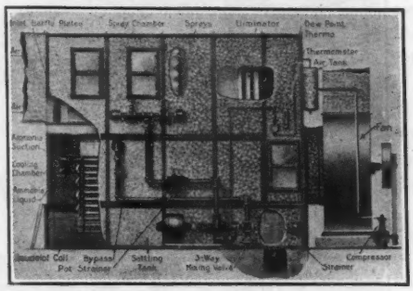


Figure 2—Typical dehumidifier, self contained

The company with which the writer is connected utilizes the thermostat described above to control the *absolute* humidity of the air, the *relative* humidity being controlled by means of a second thermostat placed in the enclosure to which the air is supplied. This second thermostat is actuated by the temperature of the air in the enclosure and acts to control the steam admitted to the heaters, thereby controlling the temperature of the air within the enclosure. Since the absolute humidity of the air is controlled at the humidifier, this second thermostat governs the relative humidity, which is, of course, a function of temperature.

In the case of dehumidifiers, during the winter, the use of well-water or mechanical refrigeration is discontinued and the thermostat is arranged to control the movement of three-way dampers which govern the relative volumes of cold air admitted from the outside and air recirculated from the system.

This control is simple and positive. It is so sensitive that the condition (the word "condition" means "temperature, humidity and purity") of the air within the enclosure (a room, the entire floor of a building, or a kiln) is maintained constantly without appreciable variation. This control is used where both the temperature and the humidity are to be maintained at a predetermined value.

Where a variation in temperature is of slight importance the humidity is controlled with a hygrostat, an instrument which responds to variations in humidity. This instrument is placed in the enclosure which is being conditioned and acts upon the spray liquid to control its temperature.

The purity of the air is a matter of great importance, industrially, because of its effect upon the health and vigor of the laborers and because of its effect upon the product in the countless cases where dust or dirt is injurious. The intimate contact of the air with the spray, followed by its passage through a series of scrubbers, of wet plates, removes all dust and foreign matter and, in several known instances, has removed all bacterial bodies capable of affecting the product in process of manufacture. This latter consideration, involving the prevention of disease and bacteriological control of manufactured products subject to molds and other contaminations, will be vigorously investigated by the newly founded Bureau of Research of the American Society of Heating and Ventilating Engineers.

After the air leaves the spray chamber and has passed the scrubbers, it is baffled through a set of eliminator plates provided with gutters which catch and remove all entrained moisture (condensed vapor present as water and carried by virtue of the velocity of the air).

The air then passes through a heater where, during the cold season it is heated to the proper temperature. Then, entering the fan, the air is distributed to the room or kiln through a system of galvanized iron ducts arranged to afford a uniform and positive distribution.

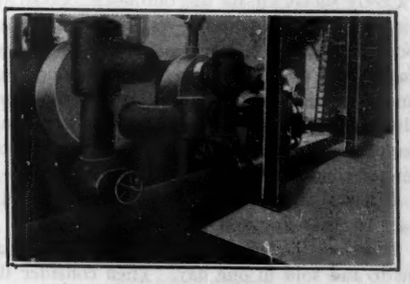


Figure 3—Shell and tube type brine coolers, United States ammonium nitrate plants

No matter how efficient and well-designed the apparatus may be, efficient results cannot be secured unless the air is effectively distributed where it is to perform its function.

Carrier Engineering Corporation, New York City. Abstract of paper before the Cleveland Engineering Society.

Counter and cross-curents must be anticipated and outlet velocities determined with great accuracy. Installations for drying or conditioning materials involve, usually, distribution problems of far greater intricacy than those encountered with large areas.

One of the principal industrial applications of air conditioning apparatus is the textile industry. Fig. 4 pictures the spinning room of a large woolen mill, showing the distribution duct in the center.

In the textile mill, air conditioning performs many important functions. Humidity must be constantly maintained at the correct value, so that the yarns will pass from one step in the process of manufacture to the next without varying in moisture content. The maintenance of a constant moisture content makes the fibers grip each other more firmly, makes them uniformly pliable, prevents breaking ends, and completely avoids the generation of static between the fibers and the rapidly moving machines. Better and cheaper textiles, cotton, wool and silk, have been made possible by air conditioning, which standardizes the routine of every operation, by technically controlling the atmosphere within the mill.

Aside from the process efficiency secured, the labor factor is greatly improved. Besides the humidity and temperature control, all of the air is cleansed and distributed to the mill without drafts, so disastrous to fine production, and to health. The uniformly maintained condition also makes for health and comfort. Health means vigor, and vigor measures the production value of the operative.

When the United States entered the war it was necessary to build aeroplanes and build them quickly. The former procedure of manufacture involved careful hand work from begining to end. The navy decided to produce in quantities by employing machine methods. An immense factory was built at League Island Yard, Philadelphia. Air conditioning equipment was installed in every building because, to permit machine methods, it was necessary to maintain constantly a predetermined temperature and humidity in every department. If this had not been done a plane built in the dry air of a steam-heated building would have swelled and parted in the comparatively moist air of the outdoors. Construction by machine methods would have been impossible because a plane is built of wood and fabric, and pieces cut today at one temperature and humidity, being subject to swelling and shrinkage from moisture variation, would not have fitted tomorrow, under different atmospheric conditions.

Fig. 5 shows one of the interiors at the Naval Aircraft Factory.

Imagine the number of loaves of bread made and sold in one day. Then consider the watchful and anxious care which your grandmother used to expend in making her loaf rise to the tender porosity you remember so well. Suppose the commercial baker had to treat every batch of dough with the same care and attention. He manufactures his own weather. Bread rises best at a certain temperature and humidity. At this condition it will rise in about three hours. Before the day of air conditioning the baker was unable to tell whether he would have to wait three hours or six hours. Today, in the more modern and progressive bakeries, air conditioning equipment in the mixing room makes fermentation a mechanically controlled process, depending upon the clock instead of guess-work. It does this by maintaining a humidity high enough to prevent surface encrustation, which would imprison the CO_2 and make the dough "heavy," and by maintaining the precise temperature at which fermentation takes place most rapidly and effectively.

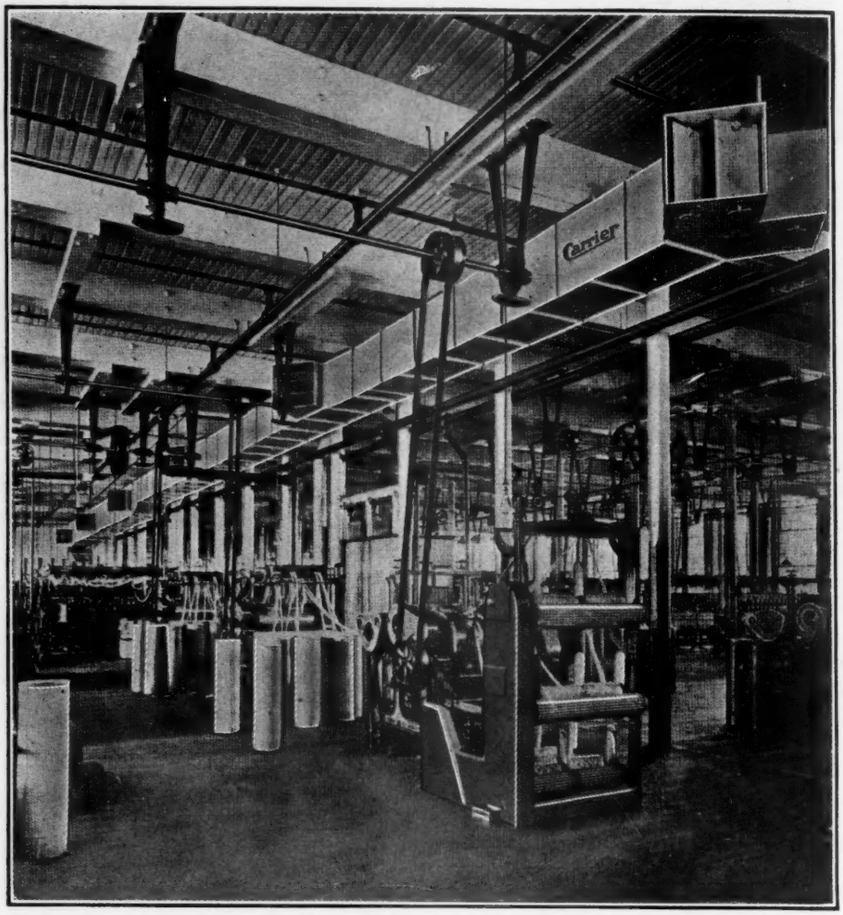


Figure 4—Spinning room, Farr Alpaca Co.

During the war air conditioning equipment played a prominent and essential part in the manufacture of war materials. We equipped several arsenals and sixteen of the fuse-loading plants in this country, and two in Canada.

In loading shrapnel fuses the powder used is very hygroscopic and so light, or finely divided, that the slightest draft will lift it into the air. They have a saying in munition plants, that if a pinch of powder is thrown into the air, it will stay there for a week. A shrapnel fuse-head is a metal cap in which there are arranged three concentric rings of powder. The upper ring is ignited when the piece is fired and the flame is conducted to the explosive charge by burning around the successive rings. The powder rings are compressed into metal segments which can be revolved so as to increase or decrease the length of the powder train. This is the method used to time the bursting charge. Great accuracy in loading the fuses is essential because, to be effective, the shell must explode within 175 feet of the point for which it is set.

An interesting test was conducted at a military proving ground to ascertain if a variation in humidity during the loading would affect the accuracy of the fuse. A photographic plate was exposed at a distance of three and one-half miles from the gun, at night, and shells were fired which had been loaded under random humidity conditions, that is, uncontrolled humidity conditions resulting from ordinary weather variations, and shells which had been loaded under controlled humidity conditions. Many of the random shells failed to show on the plate, which was exposed to cover an angle 175 feet to either side of the lens. Of the 18 shells loaded under low humidity conditions, all showed on the plate on the near side of the target, which had been placed at the center of the angle. All twelve of the shells loaded under high humidity conditions exploded on the far side of the target, but it is significant that all of the shells loaded under controlled humidity conditions fell within the limit of tolerance, all of them showed on the plate. It was later shown that all shells loaded under accurately controlled humidity conditions were subject to a probable error less than the 175 feet tolerance.

At the brewery of Piel Bros., Brooklyn, there is an installation for controlling the ger-

mination of malt prior to brewing. The best beer can be made if this germination is stopped at a given point and the malt at once placed in the brewing vats. It is extremely difficult to judge this point and a varying time is required, under ordinary uncontrolled conditions, because the process depends upon temperature and humidity. The problem was solved by installing air conditioning equipment.

Before air conditioning was applied to the candy factory, manufacture was so difficult during the summer months that many plants were shut down entirely. Those who kept their plants in operation were forced to change their formulas and methods with results not always satisfactory. Today the modern candy factory is completely equipped with air conditioning equipment which automatically maintains each department at the precise humidity and temperature best suited to the process being carried on in that department. Fig. 6 shows the chocolate wrapping room of Belle Meade Sweets, Inc.

Besides the standardization of manufacturing routine, air conditioning plays a still more important part in the production of fine candies. The only difference between the fine, rich, dark brown chocolate coating which appears on fine candies, and the unattractive mulatto-colored chocolate common to cheap candies, is that the former has been made under proper humidity conditions, and the latter has been allowed to cool without regard to the atmospheric conditions to which the variation in weather might expose it.

In the capsule department of Eli Lilly & Co., Indianapolis, is installed an equipment for conditioning the air surrounding the capsule machines. The correct conditions are maintained to harden the gelatine quickly, but not to dry it far enough for it to crack. Here air conditioning equipment, properly applied, materially increased their production and decreased their losses due to rejected pieces.

In the field of photography air conditioning has played an interesting and important role. At the Celluloid Co., Newark, N. J., air conditioning apparatus has placed the manufacture of the celluloid film base, used for motion picture film, upon a practical and efficient basis. Much trouble had been experienced in the past because the strips become brittle and break if the humidity is too low, while the film becomes opaque if the humidity is too high.

In the chemical industries many interesting installations have been made. Baking powder is being conditioned at the plant of the General Chemical Co., Perth Amboy, N. J., to keep it from caking before it can be packed. The Perth Amboy Chemical Co. has an installation for conditioning Sal Hepatica so that production can go on at full speed during the summer and winter alike.

Several other similar installations have been made for controlling the moisture regain in hygroscopic salts.

Few outsiders have any conception of the enormous amount of chewing gum consumed in this country. Suffice it to say that the manufacturers are working full time to supply the demand and several of the more progressive ones have installed air conditioning apparatus which enables them to maintain full capacity all summer. The apparatus supplies the scoring, breaking and packing departments, and a condition is maintained which keeps the gum hard and free from stickiness. The installation in one plant cost about $47,000 and paid for itself three times during the first summer.

The Butler & Butler branch of the American Tobacco Co., at Newark, N. J., have an installation for conditioning the tobacco as it is being rolled in the cigarette machines. This installation involves both humidification and dehumidification, maintaining a given temperature and humidity throughout the entire year, heating in winter and cooling in summer. By

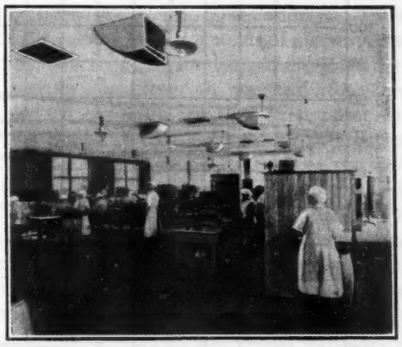


Figure 6—Chocolate wrapping room, Belle Meade Sweets, Inc., Trenton, N. J.

holding the tobacco at the correct degree of "britleness," dust is avoided and uniform cigarettes are produced at high speed.

The stemmery of the American Tobacco Co., Richmond, Va., is equipped with apparatus to prevent dust and breakage. Before the equipment was installed it was difficult to see farther than ten feet in this room. This installation reduced absenteeism about 75 per cent by providing a healthful, dust-free atmosphere for the operatives.

Perhaps the most interesting, and certainly the largest installation ever made, is at the United States ammonium nitrate plant, Perryville, Md. The equipment is used here for controlling the crystallization of ammonium nitrate. The temperature is automatically maintained at 67 degrees Fahr. at all times, and the four units supply 600,000 cubic feet of conditioned air per minute.

The refrigerating equipment consists of two units of two vertical York compressors each, each compressor developing 175 tons of refrigerating effect, or a total of 700 tons for the entire installation.

This paper might ramble on for many pages. The single company with which the writer is connected has made many more than a thousand installations, as has been said, and even a brief mention of the industrial processes contemplated would go beyond the scope of this discussion. We trust that enough has been said to bring some slight appreciation of the part air conditioning is playing in industry and to demonstrate that the equipment now developed and available is capable of meeting any imaginable requirement where the atmospheric condition affects either the process or the labor efficiency.

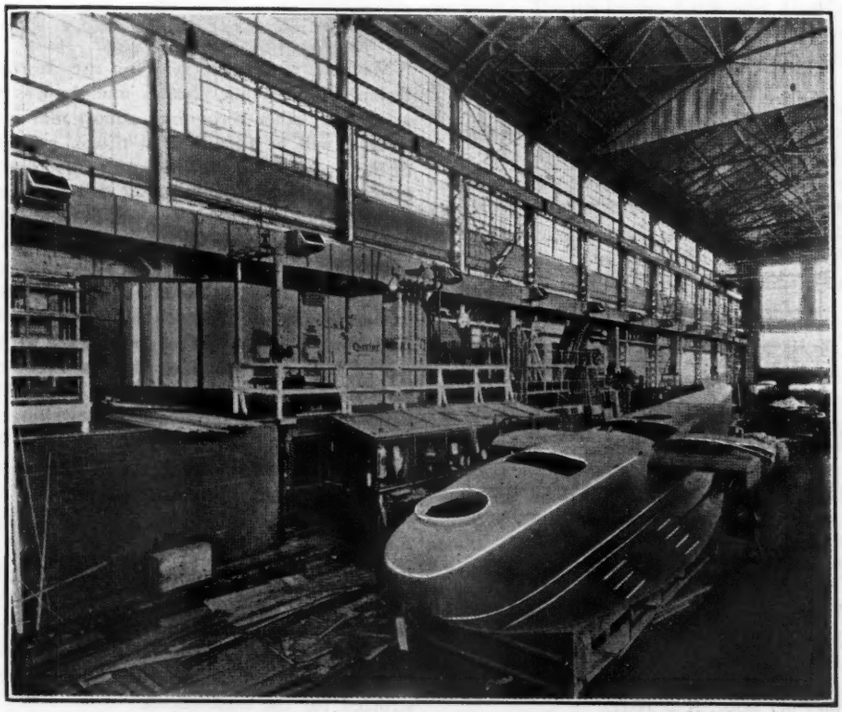


Figure 5—Assembly floor, Naval Aircraft Factory, Philadelphia, Pa.

The Riverside Portland Cement Company, Riverside, Calif., recently set off the biggest charge of nitro-glycerine ever exploded at one time in Southern California, utilizing approximately 120,000 pounds, or 60 tons of the explosive. The charge was exploded by electricity, and the rising volume of cement rock, smoke and dust was recorded on moving picture films.

The Speed Limitations of Wind Resistances

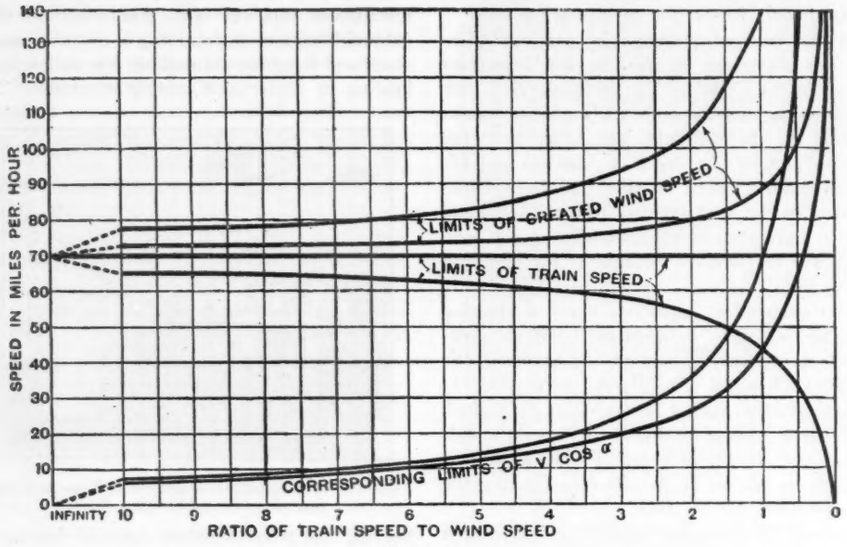


Figure 1

THE RAILWAY train, the automobile, the dirigible and the airplane when attempting their highest speeds all come to the air resistance as an important limiting and ultimately a prohibitive factor, so that a study of such resistance becomes more or less compulsory as the speed limits are approached. In an interesting study of the conditions which determined wind resistance, especially in the case of railroad trains, by Mr. C. F. Dendy Marshall in *The Engineer*, London, he first called attention that in the case of a body traveling through a fluid at a high velocity, the resistance experienced depended on the shape to an extent that has only been realized of late years. In theory, at all events, a perfect "stream line" body should experience no resistance, except that due to skin friction.

It is obviously impossible to approximate at all to a stream line form in the case of a train, but that is no reason for going to the other extreme, and utterly ignoring the question of shape.

Little has been done to try and improve matters, except that about 25 years ago, on the South-Western Railway, Mr. Drummond made some of his smoke-box doors conical in shape, a plan followed on some continental railways, and that on the Paris, Lyons and Mediterranean, a wedge formation with the same object appears to have been aimed at. Neither of these efforts met with practical success, the theory of the air resistance to bodies moving through it being comparatively undeveloped, and the necessary experimental data lacking. The cone of the smoke-box door took the place of a flattened hemisphere of comparatively quiescent air which is pushed along in front of the ordinary door. So far as it may have encroached beyond that, it must have intensified the pressure on the outer part of the front. With regard to the French engine, merely substituting sloping surfaces for upright ones is an expedient that is of rather problematical value, and one which, under certain conditions of wind and speed, has the effect of increasing the side pressure on the rail.

Thanks to the work which has been done in connection with aeronautics, it is now possible to take the matter up and study it on a scientific basis, with a promise of substantial improvement.

The importance of the front wind pressure on the engine is not fully appreciated. The horse-power required to overcome it increases with the cube, not merely of the speed of the train, but with that of what is called the "created wind," which in the case of an express train may easily exceed 80 miles per hour.

It may now be taken as established that, for speeds within and even far beyond, the range

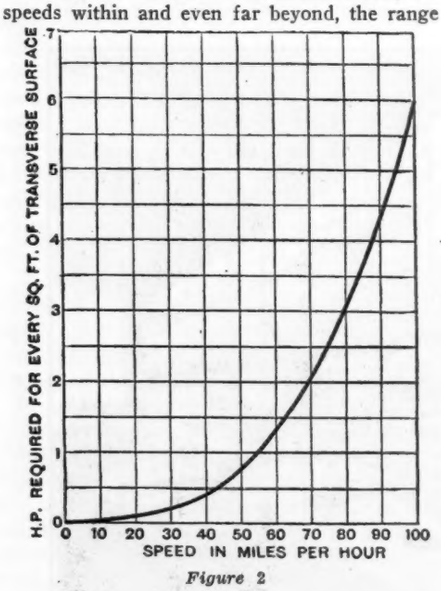


Figure 2

of railway speeds, the resistance of the air to a surface moving normally to itself is represented by the expression KAV^2, where A is the area exposed, V the speed, and K a constant. If A is measured in square feet, and V in miles per hour, K = .0033.

The constant .0033 applies to the total resistance, and includes the now well recognized suction on the back of a moving body. For plane surfaces normal to the wind M. Eiffel found in his famous experiments that the suction accounted for one-third of the total. The frontal pressure alone may, therefore, be taken as .0022 AV^2, and the horsepower required for every square foot of exposed surface is

$$\frac{.0022\ V^3}{375}, \text{ or roundly } \frac{6}{10^6} V^3$$

The value of this expression is shown by the curve in Fig. 1. At 60 miles per hour it is approximately one and one-fourth horsepower, and at 80 miles per hour three horsepower.

If we know the "all out" speed in a calm, say, 70 miles per hour, numerical limits can be assigned between which the speeds will lie for any ratio of train to wind speed. These limits are shown in Fig. 2.

Here V cos *a* represents the resolved part in the direction of travel of a wind blowing with velocity V at an angle *a* to the rails.

It will be readily understood without entering into calculation that the speed of the created wind creeps up as the strength of the natural wind increases, and that 80 miles per hour is quite a moderate figure to take for it, while Fig. 1 shows how sharply the demand for power runs up with any increase of speed in that neighborhood.

We now know fairly well that what is the best shape for a body which is to be driven through the air at speeds of the order under consideration. The front should be quite "bluff" a sharply conical or wedge-shaped form not being at all the ideal to be aimed at. What is required is to eliminate every square inch of transverse flat surface that can possibly be dispensed with, smoothing off projections, and putting in gentle curves parallel to the natural flow of the air.

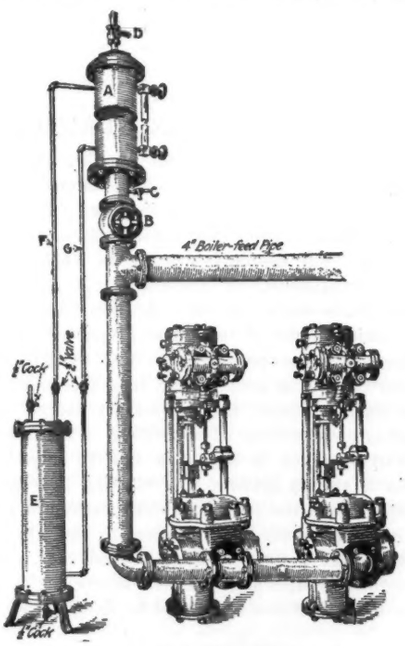
Machine tools adaptable for use in trade, technical and public schools and universities, as well as other recognized educational institutions, will be furnished at fifteen per cent. of their cost by the United States Government, as provided in the Caldwell bill recently passed by the Congress and approved by the president. The Secretary of War is authorized to sell such tools upon application in writing and the revenue realized therefrom may be used to defray expenses, except the cost of transportation, incident to the distribution of the tools. It is also provided that, in the event such material is offered for sale by such institutions, without the consent in writing of the Secretary of War, title thereto shall revert to the United States.

Capt. Ugo d'Annunzio, a son of Gabriele d'Annunzio, poet-aviator and commander of the forces holding Fiume, announced at Chicago that M. Caproni, Italy's largest aircraft producer, is planning to make a flight from Italy to the United States next May or June in a very large airplane being specially constructed for the undertaking.

Air In Pump Air-Chambers

AN AIR CHAMBER is a most necessary component of any water pump designed to work against considerable pressure especially if speed of operation is required, and a pump without an air chamber would be hard to find. The elasticity of the body of air assumed to be contained within it should do much to prevent damaging shocks to valves and piping and give steadiness to the flow. But it is the air in the chamber which does the trick, but the air is too often conspicuous by its entire absence or its minuteness and inadequacy of volume.

And how could it be otherwise? When a pump is first started the air chamber is naturally filled with air at atmospheric pressure and if the pump has to work against a water pressure say above 100 pound gage, as often occurs, the air is compressed to an



To put the air in the air chamber.

eighth of its volume or less, making it at once so small that its elasticity can be of little account. This must be the normal condition of the air in the air chamber unless special arrangements are provided for the addition of air after the pumping has begun.

Although there is nothing new in this statement of the facts a special realization seems to have only recently struck the crowd, so that within a short time we have noticed various suggestions as to how the air may be supplied reliably and in sufficient quantity.

The cut herewith shows the essential features of one of the devices actually at work and described in a recent issue of *Power* by Mr. G. B. Somer, Hawkesbury, Ont., Canada. His description follows:

At a plant where I was recently employed, the boilers were normally fed by a four-stage centrifugal pump, with a large vertical reciprocating pump as a stand-by. Both of these machines were put out of service by sand which found its way from the filtration plant, and two small reciprocating pumps of one-half the capacity of the large machines were installed and put to work. These were connected to a common suction pipe about 80 feet long, and it was at once apparent that it would be necessary to allow them to fall into step owing to the pulsating action of the water column in the suction pipe. The effect of this synchronizing was, however, to set up heavy pulsation on the discharge side, which caused the boiler-feed check valves to clatter and which also broke a tube in the economizer.

An air chamber *A* was then placed on the discharge side, consisting of six feet of eight-inch pipe with a plug at the top, a water glass being fitted so that the air volume could be observed. This air chamber was put in operation by first closing a four-inch valve *B* at the bottom and drawing the water from it by means of one-half inch cock *C* just above the latter valve, while the air entered through another one-half inch cock *D* at the top. The four-inch valve was then opened and a small air cushion formed.

Although no leak could be detected, the air volume gradually decreased, due perhaps to its absorption by the water, and the necessity for some kind of air pump was obvious. The average pressure in the feed line was about 200 lb. and the air compression would furnish only 65 lb. A displacement rig was therefore installed, the material for which was mostly obtained from the scrap pile. This consisted of another section of eight-inch pipe *E* set up in a vertical position but about ten feet lower than the air chamber. A one-half inch cock was placed at both top and bottom and one-half inch pipes *F* and *G* connecting the top and bottom of the two chambers, with valves placed near the bottom chamber. The air in the latter was displaced by the water which came down the one-half inch pipes until the pressures were equalized, and then the compressed air ascended in a few seconds to the upper chamber. A few operations sufficed to fill the latter three-quarters full of compressed air, and a few minutes' daily attention was all that was required to keep it there. All pulsation in the feed lines disappeared, and the air chamber and its home-made filling device were retained in service even after the centrifugal pump was again placed in commission.

AIR IN THE STEAM PLANT

THE FOLLOWING, which comes to us in the form of an editorial in a recent issue of *Electrical Review,* is a remarkably concise and complete statement of the function of atmospheric air and of the relations of air, water and fuel in the generation and employment of steam. It is unusually compacted with information and suggestion, and is commended to the appreciation of our readers.

In the production of steam in power plants, air, fuel and water are the raw materials employed. Air is the bulkiest raw material handled by the power plant, and a greater weight of air is handled than of any other raw material that goes into the conversion of the latent chemical energy of coal into the thermal energy of steam.

The evaporation of water per pound of coal varies from, perhaps, 4 to somewhat above ten pounds in the large modern plant. The amount of air required for the combustion of coal, likewise, varies quite widely. Theoretically, about twelve pounds of air per pound of coal are required for complete combustion. In practice, the excess air may and often does attain 300 per cent., so that in practice the air per pound of coal may vary from eighteen to 48 pounds per pound of coal. Upon this basis it can be readily seen that the weight of air handled always exceeds from twelve to 48 times the weight of coal consumed, and even at the highest evaporation of water per pound of coal exceeds the weight of water evaporated.

In the utilization of the steam, however, in contradistinction to the production of steam, a greater weight of water is handled for condensing purposes than of air for combustion. And, incidentally, this water carries away to waste about 60 per cent. of the heat obtained from the coal. The amount of circulating water used depends, of course, upon the vaccum obtained, the temperature difference of the cooling water and condensate. For low vacuum and cold water, the weight of cooling water handled may be less than that of the air required for combustion. But for vacuum above 29 inches, referred to a 30-inch barometer, and temperature of cooling water above 40 degrees, the weight of the condensing water will be equal to and will usually exceed the weight of air needed for combustion.

That a greater weight and volume of air than coal or water is handled in producing steam is a fact that should be borne in mind in laying out a power plant and in operating it. At this time of year especially it is well to remember the large amount of air required for combustion, for sometime and somehow this air must come from outdoors. With cold days and colder nights, windows and doors are closed for the comfort of the men, and absence of a definite entrance for the air may result in operating difficulties and lowered efficiencies.

It might seem that so long as air gets under the grate and thence through the fuel bed, it matters little how it gets there. But not so. With windows and doors closed and the free entry of air hindered, a partial vacuum may be created in the station, reducing the effective draft, which in turn affects the combustion rate and efficiency, ability to maintain steaming rates, tending to create smoke and taxing stack or blowers.

And then the temperature of the ingoing air to the fuel bed is a factor in furnace temperatures. Cold air only lowers the furnace temperature while air taken into the boiler room through the roof or warmed by the boiler room or losses of turbogenerators not only adds to the comfort of the men but may be transferred from the debit to the credit side of the ledger by lowering combustion losses.

Comfort of the men in the boiler room is almost as important a factor as the air fur-

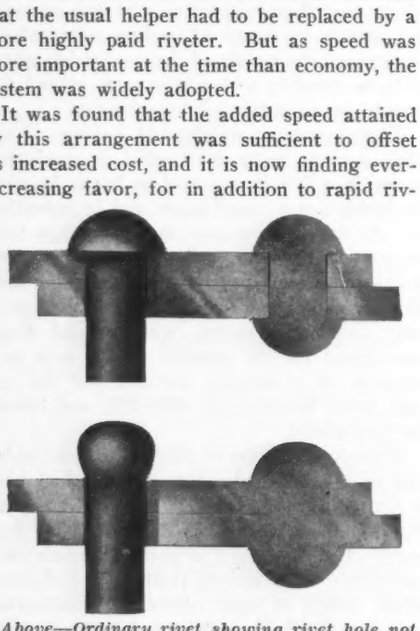
nished the fire. Both can be best served when the air supply is given as much attention as the coal and water-handling system. Too many power plants suffer from insufficient air; too many stacks are taxed because of closed doors and windows during the cold weather. The fires in too many boiler rooms are partly asphyxiated because no proper provision for incoming air has been made. And the reason for these things is not because it has been overlooked that air is one of the three raw materials required in steam making by fuel, but because the vast volume and heavy weight involved are not fully appreciated.

The air-supply system, like the coal and water-handling systems, needs deliberate consideration and wise provision unless the performance of the furnaces is to be influenced in the interests of the comfort of the boiler-room force when the cold weather comes. Plant layout cannot now very well be changed, obviously, but the effect upon plant performance of closing all doors and windows and other sources of influx for air can be borne in mind.

"TWO-GUN" RIVETING

IN ORDER to speed up work in the course of the war, many shipyards replaced the dolly bar commonly used for backing up the head end of the rivet with an extra riveting hammer. This of course, meant an increased use of air and an added cost due to the fact that the usual helper had to be replaced by a more highly paid riveter. But as speed was more important at the time than economy, the system was widely adopted.

It was found that the added speed attained by this arrangement was sufficient to offset its increased cost, and it is now finding ever-increasing favor, for in addition to rapid riveting, it has the advantage of producing a better-driven rivet. This point is well illustrated in a pamphlet issued by the American Flexible Bolt Company, illustrating their new American rivet.



Above—Ordinary rivet showing rivet hole not completely filled. Below—American rivet which when driven with two hammers completely fills the hole.

As will be readily seen from our illustration, the double-driven rivet fills the hole more completely than the ordinary type, obviating any chance of the rivet working loose, and insuring that the head is properly centered on both sides of the joint.

PONTOONS CARRY PORTABLE PNEUMATIC CAISSON

A PORTABLE pneumatic caisson mounted upon a pair of pontoons and designed for subfluvial operations, being in fact for the recovery of diamonds from the deep pools of the river Naal, is described in the *South African Mining Journal.*

A metal cylinder or bell having a dome roof which is surmounted with a tubular shaft in sections to suit depth of water to be worked, is terminated by an air-lock chamber surrounded by a water ballast tank. The dome roof of the bell is provided with means of securing, and at will releasing, a quantity of solid ballast. The tubular shaft is furnished with external runners which engage in rollers or guides attached to the deck of a pontoon or raft which carries an engine, air compressor and centrifugal pump, and possibly plant for the treatment of the gravel or material recovered. The air-lock chamber is provided with the usual manhole door and equalizing valve, together with an air-lock chute for discharging gravel; a special door closing the entrance to the tubular shaft, which latter is furnished with ladder rungs and runners for skip way, operated by a hoist fixed in the air-lock. The base of the shaft where it enters the bell is fitted with an air-tight door which may be used when it is required to lengthen the shaft. The bell is provided with collapsible seats attached to the wall for the accommodation of workers during lifting operations, and with a centrifugal pump or hydro ejector having a flexible suction by means of which the loosened gravel is deposited in the kibble or skip hoisted to air-lock or elevated direct above water level to the deck of the pontoon.

Method of Operation.—Sufficient solid ballast to partially submerge the bell is placed on the dome roof, water ballast is then pumped into the tank surrounding the air-lock in order to sink it and hold it securely on the river bed or sea bottom, and the gravel is elevated to the surface by pump or ejector direct, or hoisted to the air-lock and thence discharged through the air-lock chute projecting through the water ballast tank. The bell, or caisson proper, is fifteen feet in diameter, five feet high, and has a cone roof rising to eight feet six inches; the interior is fitted with electric light in a water-tight fitting, and has a telephone communicating to the air-lock and engine-room. A specially designed hydro ejector with a flexible suction is installed for clean-up purposes. The apex of the cone roof is surmounted with an M. S. collar-piece to which the various lengths of the shaft are bolted. The shaft is two feet nine inches interior diameter and is made in lengths varying from five feet to twelve feet; each length is furnished with ladder rungs and steel runners for skip, also with an air-pipe and five core armored cables with G. M. plug couplings for electric light, telephone and signal bells. The air-lock is six feet six inches in diameter and 6 feet six inches high; is fitted with the usual man-hole and shaft doors, equalizing and relief valves, and is placed inside the water ballast tank, which is ten feet ten inches in diameter. Through the wall of the air-lock chamber and ballast tank a gravel chute projects at an angle of 45 degrees; this is closed at either end by air-lock doors, the outer one being of special construction fitted with a positive interlocking device which prevents its being opened until the inner door is closed. An Ingersoll air-hoist, operating a ½-ton skip raises the gravel from the caisson and tips into the chute, which has a capacity of 1⅛ tons. From this chute the gravel is discharged into a bin on the deck of the pontoon, and thence elevated to a trommel, whence it is delivered to a gravitator. The pontoons are 37 ft. x 10 ft. x 2 ft. 6 in. and are connected by platform decks 37 ft. x 10 ft., thus forming a square in the centre of which is a 17 ft. x 17 ft. opening to admit of the caisson being raised for transit in shallow water. A heavy gantry standing on columns is rigged for the purpose of raising and lowering the caisson. The deck plant consists of a vertical boiler, Laval steam turbines, air-compressor and receiver.

HYDRAULIC ROCK BLASTING

A hydraulic device for the blasting of rock, and especially also for the demolition of concrete piers and foundations, is briefly described in the *Zeitschrift für Schiesswesen* of May 2, 1919. The device is due to Dr. Tubben, of the Armaturenfabrik Westfalia. A pressure pipe leads to a cylinder, 85 mm. diameter, in which eight pistons move, one after the other in telescope fashion. The cylinder is inserted into a hole drilled into the rock by an electric motor; the pistons are forced out and crack the rock. The drilling of the holes, about one inch in depth, is said to take fifteen to twenty minutes, the blasting five minutes. When the rock has been cracked, a tap is opened and the water allowed to spurt back. The device is said to have proved very successful in mines and quarries, where the concussions of explosives would be dangerous.

James S. Cunningham, of Denver, Colo., one of the rescuers of the Bureau of Mines, attached to Mine Safety Car No. 2, met death in a storage gasoline tank of the Sinclair Oil & Refining Co., at Trinidad, Colo., Aug. 25. It is thought that while attempting to connect some pipe fittings in the bottom of the tank, his half-hour oxygen breathing apparatus touched the gasoline in the bottom of the tank, the rubber in the breathing bag dissolving in the gasoline and allowing the fumes to enter the apparatus.

The inflow into the Elephant Butte reservoir for the month of August at San Marcial, N. M., amounted to 81,879 acre-feet (26,678,500,315 gallons). The greatest inflow for the month was 7,600 second-feet, on August 2, and the smallest, two second-feet on the 30th. Released from the reservoir during the month for irrigation purposes were 90,600 acre-feet, with 1,082,281 acre-feet remaining in the reservoir at the close of the month.

British Engineers Discuss Heat and Humidity in Deep Mines

AT THE BIRMINGHAM meeting of the Institution (British) of Mining Engineers, in discussing *The Control of Atmospheric Conditions in Hot and Deep Mines*, the following—here more or less condensed—went upon the record:

Mr. Eric Davis said the Morro Velho Mine, with which he was connected, was situated in the State of Minas, Brazil. It was at present the deepest mine in the world, the lowest workings being 6,400 feet below the surface and 3,650 feet below sea level. As might be imagined, therefore, the underground air temperatures were very severe. Luckily for them, however, the rate of increase of the rock temperature with depth was considerably less than the one degree Fahrenheit per 70 feet indicated as usual in the committee's report, being about one degree Fahrenheit per 140 feet over the whole depth of the mine. There were indications, however, that that rate was increasing slightly with increased depth, being at the rate of one degree Fahrenheit per 119 feet for the lowest 2,100 feet. During 1913 Mr. G. Chalmers, the superintendent at Morro Velho, instructed him to make such investigations as seemed necessary in order to overcome these difficulties. Accordingly, he took a number of readings at the various levels both in the downcast and upcast, the moisture contents were calculated for each point, and the results were plotted on diagrams having depth in feet for base. It was found that the dry-bulb temperature at any one point remained practically constant all the year round, but that the wet-bulb temperature underwent considerable variation. For the same dry-bulb temperature and barometric pressure the wet-bulb temperature depended on the moisture content, and these tests showed that, other conditions being equal (as might have been expected, the mine being a dry one) the moisture content at any point underground (and therefore the wet-bulb temperature at that point) depended almost entirely on the moisture content of the surface air entering the downcast shaft. It was found from the diagrams that in order that the wet-bulb temperatures in the stopes should not exceed 82 degrees (which they fixed upon as the maximum desirable) the initial moisture content must not be more than about 50 grains per pound of dry air corresponding to a saturated condition at 45.5 degrees Fahrenheit. The plant now being erected, which was mainly manufactured by Messrs. J. and E. Hall Limited, of Dartford, was capable of eliminating about 100,000 B. t. u. per minute, which corresponded to the reduction of their volume of air (80,000 cubic feet per minute) from an initial wet-bulb temperature of 72 degrees (slightly below the maximum actually attained) to 43.5 degrees so that it was on the safe side. As the surface wet-bulb temperatures varied anywhere during the year between 75 degrees and freezing point (32 degrees), it would be understood that the refrigerating load on the plant would be a very variable one. To meet those conditions they were dividing the plant into six stages, each complete with its own motor-driven ammonia compressor, condenser, and evaporator, and the number of these sets running at one time would, of course, depend on the initial temperature conditions. The air-cooling would be accomplished indirectly, the ammonia plant being used to cool the water, which in its turn would cool the air as it passed through two large "Heenan" air-coolers. The six stages were all on the surface. They had decided not to put any of the installations below ground. Their mine was an absolutely dry one, and therefore there was no fear of a great amount of moisture being picked up. If it were a wet mine the thing would not work. He thought the physique of the Brazilian miner must be rather different from that of his British *confrère*. He had seen men working there in a temperature of 113 degrees dry-bulb and 95 degrees wet-bulb. He had taken down a clinical thermometer into those temperatures and found that when sitting still doing nothing twenty minutes or so was quite enough to give him a rise of two degrees over 100 degrees, and the pulse went up. The Brazilian did not seem to feel it so much. Quite regularly work was being done, in a fairly good air current, at a temperature of 100 degrees dry-bulb and about 84 degrees or 85 degrees wet-bulb, and even higher at times. It was good, hard manual work, too—filling cars and so forth.

The president asked if the problem of drying the air at the same time as cooling it had been considered?

He said that the cooling, of course, did dry it. Cooling condensed the moisture in the air, and therefore dried it. They had thought at one time of using what were known as interchanges. He believed there was an installation in America for the drying of air for blast-furnace purposes in which there were interchanges. Those interchanges were on the same principle as the inter-cooler of an air-compressor except that one used the cold air going out. It took off a lot of work from the actual refrigerating machinery, and thereby the air as it left the plant was as dry as it would be at the very lowest temperature, but its dry-bulb temperature was raised. It was decided that that would not be worth the expense, and there was the risk of its going wrong. The whole plant would cost about £50,000. The power would be about 500 horsepower. Provision was being made for the extension to three further stages as they went deeper, if still further cooling should be required.

Mr. Davis said that the moisture in the compressed air gave trouble at the exhaust from winding engines and so forth. Each of the underground shafts was 1,200 feet deep, and at each 300 feet a new level was opened up. Each of those main shafts was served by a compressed air winding engine, and it was very interesting to notice the drop in temperature caused by the exhaust from that. One got quite a distinct drop at each of those places.

The President asked if the point had been considered as to whether the air should be exhausted from the mine or pressed into the mine.

Mr. Davis said that the ventilation system was an exhaust fan, and they were putting in another fan to work in tandem with that exhaust fan about half-way down the mine. The question of substituting forced ventilation had not been considered, but in connection with that new plant there was a couple of small fans being put in at the top of the downcast shaft which would operate in this way. Their function was to overcome the resistance of the air. The main difference of pressure was at present caused by an exhaust fan at the top of the upcast shaft, but a fan was being placed underground and the two would work in tandem. The water gauge was about eight inches of the exhaust fan, and the new tandem would be about six inches; the total would be about fifteen inches. The reason for not putting in a high speed fan at the upcast shaft was that they needed to get the required volume round, and they might have trouble with leakage. They had considered taking a split of air into the level, but it had not been found possible. If they gave each level a really good volume of air the velocity in the downcast would be so great as to cause considerable discomfort.

Doctor Haldane said he would like first to congratulate Mr. Davis and the St. John del Rey Company and the makers in England on the scientific way in which the problem at the Morro Velho mine had been tackled. He had been working on and off at that question ever since he had to do with the Hamstead Colliery, which was nearly twenty years ago. With regard to the temperature, he thought they could rival the Brazilians in Cornwall. A few years ago it was the case that there were men working all day in the Levant Mine with a wet-bulb temperature of about 94 degrees in their working places. He should say that they worked perhaps an hour in a shift. When he saw them they were always sitting beside a jet of compressed air, smoking and cooling down. It was the only thing they could possibly do. He had been very interested from the health point of view to see whether it did the men any harm. They all seemed extremely healthy, and he could see no trace of any harm to them. It was rather easy-going sort of work. They could not work for more than a short time. The question whether a high wet-bulb temperature was dangerous to men's health had recently been put forward in a prominent way, and he wanted to say very distinctly that he had watched for many years back to see if there was any evidence of the men's health being affected by the high wet-bulb temperatures, and he could find none. He did not believe there was any. But there was this about it, that if a man who was not accustomed to heat went into a hot place he was very apt to faint or get sick the first time or two he went in, but he very soon got accustomed to

it. The only thing one had to look out for was getting one's temperature up, and the men soon learned to prevent that. He did not know any case of a man being injured except the case of poor Welsby. He had examined Welsby's body afterwards, and found that he had three flannel shirts on—three layers of flannel in a very warm and moist mine. He had never been accustomed to anything of the sort before. If Welsby had been a Hamstead man he would never have thought of going in with a rescue-apparatus on and several layers of flannel over his body as well. Of course, the temperature question was important. Firstly, it came to be mostly an economic question, because naturally men did not like so well to work in air where they were constantly sweating as in cooler air, although they seemed to get accustomed to it.

PLANS FOR MANUFACTURES CENSUS COMPLETED

Special effort is being put forth to make the manufactures section of the present Fourteenth Decennial Census the most complete and comprehensive inventory of the nation's manufacturing establishments ever taken, according to officials of the Bureau of the Census who have this work in charge.

The schedules which will be used in tabulating the information about the country's industrial resources have already been prepared and printed. These schedules were mailed to every manufacturing establishment in the United States in December so that factory owners and managers could familiarize themselves in advance with the questions to be answered when the records of the last year's business had been compiled. The questions relate to the calendar year 1919.

In 1914, the year the last manufactures census was taken, about 275,000 manufacturing establishments were listed by the Census Bureau. This time more than 300,000 establishments will be sent schedules. In addition to this it is expected that about 50,000 mines and quarries will also be reported.

The inquiries relating to manufactures, as specified by the Act of Congress providing for the Census, include the name and location of each manufacturing establishment; character of organization, whether individual, corporate or other form; character of business or kind of goods manufactured; amount of capital actually invested; number of proprietors, firm members, copartners and officers, together with the amount of their salaries; number of employees and amount of their wages; quantity and cost of materials used in each establishment; quantity and value of products; principal miscellaneous expenses; time in operation during the year; character and quantity of power used; and character and number of machines employed.

The questions as outlined above will be covered by the general schedule which every establishment will receive. In addition to this a supplemental schedule will be sent to the 68 principal industries as classified by the Census Bureau. This supplemental schedule will allow detailed statistics of output to be set forth under the heading "products manufactured."

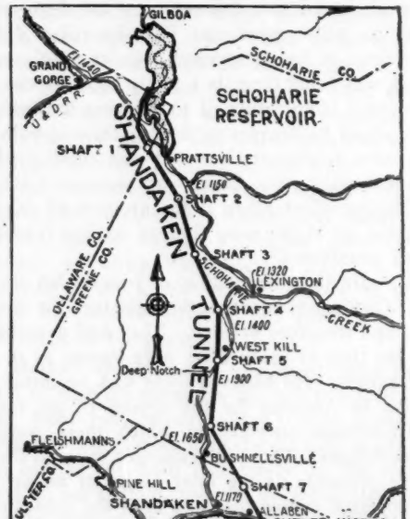
Census Bureau officials emphasize the fact that all information gathered by the census is strictly confidential, made so by Act of Congress, and is for general statistical purposes only. The same is true of the censuses of population, agriculture, mines and quarries, oil and gas wells and forestry and forest products.

Many startling figures are expected to be shown by the approaching compilation inasmuch as the industries of the country were for the most part in a subnormal condition in 1914, the year the last manufactures census was taken.

2000 MEN WILL WORK 5 YEARS ON SHANDAKEN TUNNEL

The Shandaken Tunnel contract, awarded to the Degnon Contracting Co., is a part of the Schoharie development of the Catskill water supply of New York City. This tunnel will be eighteen miles in length, and with the exception of about 600 feet at the portal, will

Map showing location of Shandaken Tunnel.



Courtesy *Engineering & Contracting*

be through blue limestone formation, lying in horizontal strata and containing very little water.

Electrical power is supplied to the shafts at 33,000 volts, three phase, 60 cycles, and will be transformed to suitable lower voltages for the air compressors, hoists, pumps and other machinery. Tunnel transportation will be by means of electrical power, using storage batteries for short hauls and trolleys for long hauls.

Leyner-Ingersoll drills will do all of the rock work.

WORLD'S BIGGEST DRYDOCK

The new Commonwealth drydock at South Boston is the largest drydock of its type in the world. It is situated off the main ship channel in South Boston, and is ideally located. The Navy Department has agreed to buy this drydock, when it is completed, from the State on a cost-plus basis. At the present time it is 95 per cent. completed. The particulars as to dimensions are as follows: Length at bottom, 1,170 feet; width at bottom, 114 feet nine inches. Depth over sill at low water, 35 feet. The size of the largest vessel which it could accommodate is 1,150 feet in length; beam, 115 feet; draft, 45 feet, high water. It is built of concrete side walls with complete granite facings. It has a floating steel caisson that is brought into place by electric winches. The length of the caisson is 138 feet six inches: width, 27 feet; depth, 53 feet six inches.

NEW JERSEY CANAL WILL SAVE 187-MILE HAUL

The Board of Trustees of the City Club of New York, has indorsed the contemplated project of the Federal Government to build a canal across New Jersey from Bordentown on the Delaware River to Morgan on Raritan Bay.

"The committee in indorsing this project does so with the understanding that this is but a part of the Intercoastal Waterway System and that it is intended by the Federal Government to improve the Chesapeake and Delaware canal already taken over by the Government, and to deepen the East River and Hell Gate," said the resolution of indorsement.

The canal line surveyed by Government engineers is almost a straight line crossing the State at the narrowest part. The length of the canal from Bordentown to Morgan is 33.7 miles. The distance from the wharves in Philadelphia to the Battery in New York City by way of the proposed canal would be 87 miles. The present route between these two points is about 274 miles.

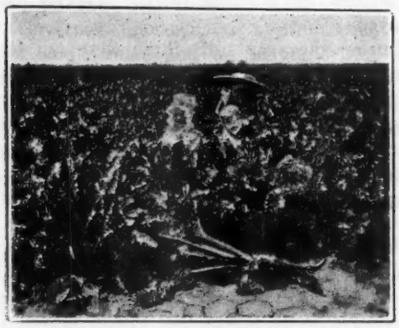
A LARGE SAVING OF COAL

One of the largest hydro-electric plants in North America is to be built at Little du Bonnet Falls, on the Winnipeg river, a short distance northeast of Winnipeg, Canada. It is proposed to expend $9,000,000 on the work and the expectation is that 160,000 horsepower will be developed. The first step will be the building of a concrete dam 2,000 feet long and of a maximum height of 70 feet across the Winnipeg river at Little du Bonnet Falls. The dam will create a reservoir from 50 to 70 feet in depth, extending several miles up the river to the second McArthur Falls, and by raising the river's level will drown out Grand du Bonnet Falls, where the river drops 35 feet in four plunges. Eight turbines of 21,000 horsepower each, of four-runner, horizontal shaft type will be installed in pits in the concrete substructure. The water from the reservoir will pass directly into the turbines at 20,000 cubic feet per second. The power generated at the plant will be conveyed to Winnipeg by a double circuit transmission line supported across country on structural towers 54 feet high.

Sugar, Limestone, Dynamite and Compressed Air

HOW the several items in the above title are related in a great industry is told in an interesting way by E. T. Lednum in *Du Pont Magazine*. Only a small portion of the story is here reproduced.

Of no small importance is the part that



1.—Some Beets.

dynamite plays, thanks to the rock drill and the air compressor, in the filling of the family sugar bowl. Limestone is an essential factor in the process of obtaining the sugar from sugar beets, and dynamite, in turn, is essential in blasting the limestone from its natural bed. Moreover, dynamite is also used in many cases to improve soil conditions for the growing of sugar beets.

The limestone used in refining beet sugar must be of high purity—of from 96 to 98 per cent. calcium carbonate—and in blasting it great care must be exercised to produce the stone in such physical condition as will permit its most economical use by the refinery.

After the beets are harvested and delivered to beet sugar mill, they are washed, sliced and carried to diffusion batteries where sugar is extracted from the beet chips. The raw juice is carried through heaters to the mixing tanks, where lime or saccharated milk is added. After the heating and mixing, the juice is carried into tanks where carbonic acid is introduced in order to neutralize the lime.

Explosions blast the limestone from which saccharate milk of lime is produced. Limestone and coke in fixed quantities are burned in a lime kiln. These kilns are located at the beet sugar refineries, as not only the lime but also the gas produced is used in the refining process.

In the "Steffens" process, the burned lime is passed to a crusher and then elevated to the grinding mills, where it is ground to a fine powder. From the powder storage bin it is passed to the coolers, and so on. The quantity of lime used is determined by the quality of the beets, the fineness of the powder, and the temperature maintained.

Lime, in conjunction, generally, with sulphur dioxide gas, is also the most important chemical used in the manufacture of raw cane sugar. The amount of lime used in proportion to the tonnage of cane sugar is, however, much less than in beet sugar manufacture; nevertheless, the total quantity of lime used in the cane sugar industry is large in the aggregate. Thus dynamite, backed by compressed air and the rock drill, finds a sure and necessary, although an indirect use, in preparing sugar for table use.

2.—Typical Limestone Quarry.

AIRPLANE SUPERCHARGER PROVES ITS VALUE

In the flight made by Major R. W. Schroeder, with Lieutenant George W. Elsey as passenger, at McCook Field, Dayton Ohio, for the purpose of testing the new "supercharger" for airplane motors and to obtain additional data for mapping aerial trade winds, a new world's altitude record of 31,800 feet for a plane carrying a passenger was made, according to the Contest Committee of the American Flying Club, which homologated the records of the performance. Speaking of the flight, Chance Voight, Chairman of the committee, made this statement:

"Major Schroeder's record of 31,796 feet was made with a passenger, flying a Lepere biplane equipped with a 400 horse-power Liberty motor, equipped with a 'supercharger.' The machine is actually capable of 37,000 feet, for at the time when 31,500 feet was reached he was still climbing, indicating that, even with pilot and passenger the machine was good for at least 36,000 feet. The 'normal ceiling' of this type of plane, carrying fuel tanks, pilot, observer, and special instruments, is only about 22,500 feet as a military fighting machine, and the marked difference in capability has been brought about by the use of the newly invented 'supercharger.'

"According to experimental data in the possession of the technical sections of the Air Service, it has been found that at a height of 20,000 feet an airplane engine only gives 45 per cent. of the power yielded at sea level. The tremendous value of the 'supercharger' lies in its ability to make a motor yield the same horse power at 20,000 feet that it does flying at the lowest altitudes. Whereas his machine is capable of a speed of 136-7 miles per hour at sea level, at 25,000 feet, the altitude at which most of the air fighting in the next war is expected to take place, Major Schroeder's biplane has shown a speed of 134 miles, a loss of only two-thirds of a mile per hour."

Major Schroeder is the chief test pilot for the airplane division of the Air Service and has made many valuable contributions to the development of plane motors.

PRESSURE ADJUSTMENT FOR THE REGO TORCHES

In the Rego torches, which have been developed by the Bastian-Blessing Company, Chicago, for cutting and welding frogs, rails and other track material a new departure from existing apparatus has been made in the principle and practice of mixing the gases. The acetylene is delivered at the mixing chamber at a pressure slightly greater than the pressure of the oxygen. With this arrangement the acetylene holds back any excess of oxygen under all conditions, thus eliminating the flashback, which is a source of continual annoyance in most welding and cutting torches.

In the construction of the torch several innovations are introduced; no high pressures are used, the acetylene pressure, even on tips larger than one-eighth inch, being only nine pounds. In order to secure the correct volume of the gases, the mixing is accomplished in the tip so that the mixing chamber is changed each time that a different tip is applied. This form of construction facilitates repairs and reduces the volume of the mixed gases. The tip is of an alloy high in copper and is made without a thread and with a cone seat having a broad angle to prevent the tip sticking in the head.

The cross section of the oxygen passage leading to the mixing chamber is of substantially the same cross section as the mixing chamber itself, while the acetylene passages have a cross section equal to approximately one-half the area of the mixing chamber. Both gases are delivered to the point where they mingle at a velocity higher than the rate of flame propagation in the mixture which will produce the neutral flame. The arrangement of the passages normally produces the neutral flame, and any obstruction of the tip will result in an excess of combustible gas in the mixing chamber, which reduces the rate of flame propagation at the point of mixing. Thus, if a condition is present which tends to cause a flashback the acetylene immediately shuts off the oxygen, automatically producing a rich mixture which will not backfire.

It is claimed that this torch positively prevents the flashback, thus eliminating the time wasted in relighting the torch. It is also claimed that it effects a marked saving in the gas consumption, insures a better quality weld and permits the employment of less skilled labor than can be used with torches which do not employ the same principles of mixing the gases.

What is said to be the largest airplane engine in the world was recently put under its first test in England. It is reported to be of 1,000 nominal horsepower and to develop about 900 horsepower at normal working speeds.

Dangers in the Transportation of Powerful Explosives

COL. B. W. DUNN, of the Bureau of Explosives of the American Railroad Association, delivered an address on Acetylene Transportation before the International Acetylene Association as its recent convention. His paper follows:

I found, when I assumed charge of the then newly formed bureau, and was talking to the manufacturers of dynamite, I could only refer to my fears as to what might happen in the transportation of this product, because my office had no data of what actually had happened. The dynamite men buttonholed me in the corner of a room and assured me that, confidentially, I was on the right track in looking out for these transportation risks; but I would find all the dangers in the case of the man who made black powder, and the man who made dynamite was all right. In due course, when I met the black powder man, he buttonholed me and assured me to the contrary, that all the risks were with the dynamite man.

We have had reported to us with regard to accidents in manufacture requiring the use of acetylene gas a total of 39 accidents, causing the death of sixteen persons and injuries to 45 persons.

With regard to accidents in the manufacture (compression, generating or charging) we have had 27 accidents reported, causing the deaths of 26 persons and injuries to 55 persons.

In connection with the storage of acetylene, we have had six accidents reported, causing the death of one person and injuries to 14 persons.

In connection with miscellaneous accidents, accidents in handling, and similar accidents, we have had five accidents causing the death of one person and injuries to four persons.

This covers the period of twelve years since the organization of the bureau. The number of accidents in the transportation of compressed acetylene gas reported to our bureau in that time was 24, in which one person was killed and there were seventeen persons injured. It is gratifying to know that the accidents in transportation are relatively small in number and not very disastrous in result.

Now, as to how can it be made better in the future. My experience of twelve years in this field teaches me that one way to make transportation hazards better is to secure the enforcement of well-designed standardized methods of manufacture and packing and handling in transit of the products that you manufacture.

When this work was started there was no standardization, no rules, no uniform practice, and it is not surprising that the transportation interests of the country suffered largely through handling such materials as dynamite and high explosives. In fact, the first year of our work, 1907, the first year that we attempted to seek any data, showed, as I recall the figures, something like 54 persons killed and 80-odd persons injured by explosions that occurred on railroad property, and about half a million dollars' worth of property destroyed.

During the year 1918, there were not less than 50,000 cars on the railroad tracks of the United States, somewhere practically every day, bearing high explosives, which were required for the service of the government—in spite of all that large volume, there was not a single person killed in the United States as the result of the transportation of explosives.

When it comes to acetylene we have this trouble: You know, as well as I do, that the potential danger in regard to it looms large. There are many things that might happen if certain things are not done; and to the railroad man, those things that might happen, in spite of anything he can do, are the ones that impress him most. It is the "concealed hazards" which cause him the most concern. The railroad man, for example, hates the mention, even, of an article that is subject to spontaneous combustion, simply because in spite of all his care he may find his car on fire, and the car may be on fire next to another car containing a dangerous inflammable product, so a conflagration may follow.

MANY ADVANTAGES OF THE PRESSURE BRAKE

Much as we have been wont to marvel at the ingenuity shown in the design of the braking apparatus on our cars and locomotives, and much as we deplore the loss in effectiveness of this equipment coming about from neglected maintenance, says an interesting editorial in *Railway Review* we neither marvel nor deplore sufficiently to properly do homage to that intelligence which gave us a heritage in the *pressure* rather than in the *vacuum* form of brake. In England, and to some extent on the continent, the vacuum type of brake is in vogue. A review of the shortcomings of the vacuum principle, a realization of which appears to be dawning abroad, should inspire us with new and ever increasing reverence for the name of Westinghouse.

In the first place the maximum vacuum attainable under ideal conditions is but 14.7 pounds per square inch, which is the pressure of the atmosphere at the earth's surface. Of all physical conditions difficult to maintain a vacuum is among the worst—"nature abhors it." As a consequence the equivalent of fourteen inches of mercury, about seven pounds, is held to be a good average brake pipe "pressure" where the vacuum system is in use. The "pressure" being so low, the cylinders must be proportionately large and bulky, 21 inches being the prevailing standard diameter. In spite of their size, three to four such cylinders are needed on cars weighing over 30 tons. Two equipments with cylinders of this size weigh something like half a ton. Equivalent power in a pressure equipment represents a weight of about 125 pounds.

The low pressure necessitates large diameter pipes and fittings which are not only disproportionately heavy and expensive, but are difficult to keep tight. Hose must be armored against collapse instead of bursting. Expansion of the air in the vacuum brake induces low temperature and worse conditions from freezing than any with which our air brake maintainers have any knowledge. Opening a hose coupling causes an inrush of air carrying with it quantities of foreign matter which, with the pressure system, are repelled.

For a long time argument used to be offered in favor of the vacuum brake because of its alleged greater simplicity. When, however, it comes to the matter of a "reversing" vacuum brake, there are introduced as many as five train lines, with their hose connections, etc. All in all, it seems we should be pretty well satisfied to continue with the pressure form of brake.

A GOVERNMENT CONTRACT—NOT AMERICAN

The *Monthly Journal* of the Sheffield Chamber of Commerce and Manufacturers relates the following "Story of a Government Contract." A certain Sheffield firm, under control, supplied 600 per week of a particular tool of their make to the Ministry of Munitions (Supply). The contract was subsequently reduced to 300, and, on the signing of the Armistice, the firm, having good ground for believing that the Government held a considerable surplus, ceased to send further supplies. No notice was taken officially of the matter until April, when the Ministry wrote requesting that the deliveries should be immediately resumed, and asking for delivery of arrears. To this request the firm acceded to the extent of 300 at once and 2,000 within three weeks. The firm's travellers shortly afterwards discovered some of their old customers were buying the tools cheaply from old stock at Government stores and at auction sales, some having acquired them at as low as ten shillings a dozen. What that meant to the firm may be gathered from the fact that during the war they had accepted the Government's own price of 27 shillings a dozen, which left no profit margin, and that the normal market price was 42 shillings a dozen.

Harry Barker and Robert C. Wheeler have become associated in partnership and will engage in the private practice of engineering at No. 170 Broadway, New York City. In military service Mr. Barker was a captain of engineers and Mr. Wheeler held the rank of major in the Construction Division.

Col. William R. Livermore, U. S. A., retired, who, together with English engineers, laid the cable from the United States to Havana in 1868 and who, as a young officer in the Corps of Engineers, was connected with fortification work at Key West, Tortugas, and Atlantic Coast ports, died recently at the army hospital, New York City, aged 77 years.

Production vs. Slacking—An Earnest Appeal to Labor

*By HARRY A. MACKEY**

MASSACHUSETTS recorded her verdict couched in the language and pitched to the temper of the nation. The leaders of labor ought to take notice of the fact, that, without respect to party, distinguished men from all the States heralded the election of Governor COOLIDGE, as a vindication of right and justice and an assurance of the stability of our people and the perpetuation of the Republic. American citizenship promptly acclaimed the result of the Massachusetts election as establishing the fact that American democracy shall survive, that class shall not prevail over class, and that one group of citizens, in mistaken zeal, shall not imperil the rights of the whole.

The verdict of the people of Massachusetts was also universally accepted as a guarantee that might is not right, and that the rules of conduct of a small group shall not be substituted for the fundamental laws of the land. The result in that election also proclaims that America is still the great melting pot of the world, and that men of all grades of education, enlightenment, social relations and racial entanglements, will ever come out of this human caldron, real pillars of our democracy, acknowledging the supremacy of the law and recognizing the authority of properly constituted officials.

Those in leadership of large groups of the working classes should consider, not so much the result of this election, as the temper of the American people. A hundred and more millions of people will be impatient with inconveniences, privation and suffering brought to their doors by small groups which seek by force and the infliction of suffering, to bring about a readjustment of their real or imaginary grievances.

My appeal is to the thoughtful, red-blooded, honest, home-making workman of our state. He ought to stop and assert the independence and sovereignty of his own individual self, before he blindly allows others to precipitate him into a situation that is going to bring suffering and privation to the homes of all our people, his own included, and, with the temper of the people as it now is, will render his organization impotent for future usefulness to himself and his fellow workmen.

In my intimate relationship with the workmen of Pennsylvania, I know how the individual workman feels. I know of no substantial bread winner in Pennsylvania who, prompted by his own judgment, would cease, at this time, to do a man's part. Now is the time for such men to stop and consider how far they will follow an irrational and un-American leadership. The workmen of Pennsylvania ought to continue at the task of production at this crisis, for a number of reasons.

It is every man's duty at this time to work as he never worked before. This is no time for men in offices or in the mines or in the factories to limit the amount of work that they can do. A situation is upon us all that has grown out of abnormal conditions, and I know nothing that will solve all our problems as much as constant and untiring labor. This applies to the men in the offices, mines, mills, upon the farms and in every walk of life. It is unpatriotic for any of us, yes, unworthy of our manhood, to seek to escape long and arduous hours of toil. When we all make up our minds to do this, many of the problems that now seem impossible of solution, will solve themselves.

As a matter of fact we have too many leisure hours. Men, while idle, spend money foolishly. They rush into extravagances that they would never dream of were their minds bent upon their tasks and their spirits consumed in the desire to produce much. In my judgment the real solution of the problem of the high cost of living, is to work and work and produce and produce.

More than this, with our minds all bent upon our tasks, and striving each one to excel the other in our production, we will have no time to allow our minds to wander from the fundamentals of our democracy—the agitator will be passed up as a public menace, and all will be happy and contented in activity.

Our workmen ought to remember that they owe great consideration to the people of Pennsylvania. There are three parties to every labor controversy, the employer, the workman and the great consuming and paying public. The latter in cases that involve strikes or limitations of production, is the most important party, and should have the most consideration. The workmen of Pennsylvania ought to consider the interest of the public first, because of the gratitude that labor should feel toward the people of our State. Our workmen, in my judgment, are favored far beyond any group in any other state of this nation, or of any other country of the world. Millions of dollars have been spent through the instrumentalities of service created by the legislature for the benefit of our workmen, and the burden of all these benefits has fallen upon the public, either in the form of taxation or as an added cost of production.

The Department of Labor and Industry, with its various sub-divisions, has ramified into every nook and corner of the state, and guarantees to the workmen of Pennsylvania safe and secure places of employment, insisting upon proper hygienic and sanitary conditions, and enforces the law that guarantees fair treatment and proper hours of work to the youth and to the women, as well as to the men.

The Department of Health is organized in every hamlet of the state in order to give to our people who toil, the privilege of living under healthy conditions. The great public of Pennsylvania has supported the administration of the workmen's compensation law, which during the last four years has taken aid and comfort at crucial times to upwards of a million injured workmen and has distributed millions in money to the dependents of those killed in industry, and to those who have been temporarily incapacitated.

A workman therefore ought to consider well, when the very industrial integrity of our country is at stake, whether he is going to so try the patience of a bountiful public, that he will lose for himself that great zeal of our people that has heretofore been manifested for his care and comfort and for remedial legislation in behalf of the man of labor.

The right of workmen to form organizations to advance their own interests is a fundamental doctrine of human liberties, and no man ought to gain a patient audience who would seek to deny this right. The right of collective bargaining is also fundamental, and has been thoroughly established. But a patriotic workman, without a grievance in his own working establishment, ought not to be persuaded to forsake his honorable endeavors through the advice of strangers or selfish agitators who have no interest in common with the community they enter to disturb.

Because of the condition of the times, capital is invested in most precarious undertakings. The investor cannot limit the hours of his work. The professional man must stick to his task until his job is done, even if it takes him into the small hours of the morning. The lawyer must prepare his briefs when working men are asleep, and the physician cannot deny a visit to the suffering, no matter what hour of the day or night he is called.

Huge income taxes are laid upon those who venture their money in industry. They must be paid to support the Government. There can be no escape from payment. There must be coöperation between employer and employee. There can be no pay envelope unless there is some profit. With false doctrine stalking broadcast over the land, with the future of organized labor at stake, with every man's patriotic duty plainly understood, with a cry of humanity going out to us all to help produce the necessities of life in order to knock down prohibitive prices, dogmas of irresponsible agitators ought to be ignored. A deaf ear ought to be turned to those who are urging men to adopt revolution and force, and all American citizens should be devoted to the task of overcoming and solving our difficulties by one common understanding, and that is—that we will work night and day without limitation as to the time and without quibble as to individual rewards.

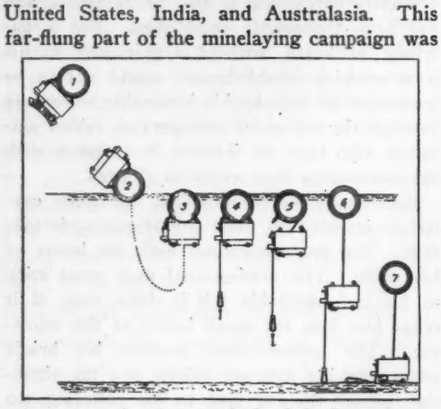
Real friends of labor are greatly concerned as to its future. They realize that this is its day of trial. It faces self determination. It can continue in public confidence or wreck itself upon the rocks of bad advice.

Chairman Pennsylvania Workmen's Compensation Board.

Reuben E. Smith was drowned through the overturning of a boat on a river north of Vladivostok, early in October. It is suspected that it was not an accident. He was recognized as one of the most intelligent men engaged in prospecting in Siberia. His wife and two children are at Vladivostok.

LESSONS TAUGHT BY NORTH SEA MINE BARRAGE

THE November number of the *Journal of the United States Artillery,* Fort Monroe, Va., contained a highly interesting article by Capt. Reginald R. Belknap, U. S. N. on the subject of submarine mines as utilized in the late war, especially in the famous North Sea Mine Barrage. Captain Belknap observed that the shipping of the Central Powers being swept off the sea made the merchant shipping losses from mines fall mainly upon the belligerent which had command of the sea. That command was not complete enough to stop the enemy's mine laying by submarines and by an occasional raider escaping through the blockade. The latter carried the enemy's mines to the British, French, and Mediterranean shores and even to the waters of the United States, India, and Australasia. This far-flung part of the minelaying campaign was



Drawing showing method of laying mines

surprising and spectacular, but it could not be maintained, nor even begin, in sufficient strength to have more than temporary and local effect. Great importance attaches to it, however, as a warning of what may be done, and what to prepare against in the future.

Standing out from all other mining operations was the laying of the Northern Barrage, that great minefield barrier across the North Sea, from the Orkney Islands to Norway. This measure aimed to supplement the convoy system and the patrol against submarines, by stopping the submarines near their home bases, before they could scatter over the trade routes.

One thousand mines a day became the guage for all preparations, which included the establishment of a large plant at Norfolk, Virginia, for charging the mines with the explosive, and the exclusive assignment and equipping of a large steamship pier at Norfolk, for stowing the mine parts awaiting shipment and for loading the mine carriers. The numerous mine parts, manufactured by some 500 contractors, scattered over eastern and middle states, flowed to Norfolk, whence 24 specially allotted small cargo steamers, two or three sailings in convoy every eight days, transported them to the west coast of Scotland. There they were sent by rail, or by barge through the Caledonian Canal, to Invergordon or Inverness, on Moray Firth, just above Aberdeen.

At each of these places a mine assembling base had been prepared, manned by a force of twenty American naval officers and 1,000 seamen, to do all the work in preparing the mines for issue to the minelayers, ready for laying. The whole shore establishment was under command of Capt. O. G. Murfin, U. S. N., and, together with the Mine Laying Squadron and the repair ship *Black Hawk*, formed the Mine Force, a separate part of Admiral Sims' whole command. It was under the immediate command of Rear Admiral Joseph Strauss, U. S. N., Commander of the Mine Force, U. S. Atlantic Fleet, with headquarters at Inverness. The personnel of the Mine Force, afloat and ashore, numbered about 250 officers and 7,000 men. There were ten ships.

Many were the vexatious delays, Captain Belknap said, in spite of efforts to anticipate every probable cause of them, but on May 11, 1918, seven of the ten vessels were readv and their crews sufficiently "shaken down," to warrant sailing for abroad. After an eventful passage over, the Mine Squadron, Captain Belknap commanding, arrived at its bases in Scotland ready to begin operations, May 26, 1918, and twelve days later, at midnight, June 7, it departed on the first minelaying excursion.

There were, in all, thirteen regular and two special excursions by the American Squadron, and eleven by the British. Together they laid 70,117 mines, of which 56,571 were American. The minefield occupied an area 230 miles long, averaging 25 miles wide, forming an obstruction to any vessel drawing ten feet or more, whether on the surface or submerged. The obstruction extended as deep as 240 feet over all but the eastern section where it went only as far down as 125 feet. Rows of mines were 500 yards apart which was as near together as it was safe for minelayers to steam in line abreast formation. The spacing between mines in the same row was 300 feet—as near as they could be without suffering structural damage in case a neighboring mine exploded, as from six to ten per cent defective mines did.

A vessel of 30 feet beam thus had four chances in five of passing through a single barrier line of mines unharmed, but as there were from six to ten lines in parallel, the chances of slipping through the whole barrier unharmed varied from only one in four where the barrage was thinnest to one in nine where it was thickest.

Definite information since the armistice (up to March 1, 1919) credited the Northern Barrage officially with the sinking of four submarines certainly, two more probably, and possibly yet two more, making a total of eight. There are reports of three others damaged, but these reached a German port in safety. The speeding operations, which have been in full swing for many months, may establish that still more submarines came to their end in the barrage. Already there are some indications of it. Further, Admiral Sims' summary states:

> There is no doubt that this barrage had a considerable moral effect on the German naval crews, for it is known that several submarines hesitated some time before crossing. Also, reports from German sources are that the barrage caused no small amount of panic in some of the submarine flotillas. It is also probable that the barrage played a part in preventing raids on Allied commerce by fast enemy cruisers.

Other information indicates that knowledge of the barrage and its growing effectiveness had spread outside of naval circles, among the army and the civilian population.

In his article, "The Victory at Sea," Admiral Sims mentions a barrage across the North Sea, from the Orkneys to the coast of Norway, as one of the ideas suggested early in 1917 to solve the submarine problem, but it was not among the possibilities then, for lack of mines. At that time, there were not even enough mines to make a successful barrage across the Strait of Dover, only twenty miles wide.

Of the eight submarines credited to the Northern Barrage, only one was sunk prior to September 7, 1918, the date on which the barrier was extended completely across the North Sea. This leaves a toll of six or seven submarines *destroyed* during only a two months' period of the barrier complete before the armistice. This indicates how many more submarines would have been destroyed or damaged, had it been permitted to carry the barrier completely across earlier, as could have been done. Much more than that, does it not indicate what decisive effect the Northern Barrage could have accomplished, had the development of mines and minelaying progressed along with other weapons, to the extent that former wars had shown to be reasonable? The probable results of such development, Captain Belknap concluded, would have been that suitable and sufficient mines and minelayers would have been available much earlier, to establish the barrage when its need first became acute, and thereby hasten by many months the end of the submarine menace.

BRITISH COLLEGE PLANS NEW TRADE DEGREE

An important step toward the further development of British foreign trade is indicated in the plans announced by the University of London for establishing degrees in commerce. The National Foreign Trade Council learns from London that it is proposed to institute a three-year course of study leading to the degree of bachelor of commerce. The addition of a minimum of two years' practical experience in the particular trade or industry selected would qualify the candidate for the degree of master of commerce.

The work of the first year would comprise the compulsory subjects of organization and industry, banking, trade and transport, elementary economic developments of the British Empire and chief foreign countries, commercial law and statistical methods. The second and third years would be devoted to specialization.

The scheme has the warm support of representative men in Britain's foreign trade, who are urging all business men to contribute liberally in support of this programme in order to secure for British commerce the advantages of a thorough and recognized commercial training.

Care of Pneumatic Tools in Pacific Coast Shipyards

By C. J. ALBERT

THE MOST important adjunct in the building of the emergency fleet in Pacific Coast ing of the emergency fleet in Pacific Coast yards was compressed air, or pneumatic tools. Without them speed would have been out of the question. One only needs to imagine the length of time necessary to build, especially steel ships, by reverting to the old hand methods. Therefore, the use of riveting hammers, chipping and caulking hammers, air drills, pneumatic riveter holders-on, portable emery grinders, to speed up the work over hand methods, is so obvious that one need not argue their necessity.

There are no tools, however, in modern shop practice, which receive the hard usage that pneumatic tools labor under, especially riveters and chippers, because of the intense vibration to which they are subjected. This vibration is bound to produce crystallization sooner or later, regardless of the fact that the best materials obtainable are used in their manufacture.

Then again, the tools must be made to such close and accurate dimensions and maintained to their original dimensions as closely as possible during the life of the tool, or they lose their efficiency. An inefficient pneumatic tool is the bane of an operator's life.

No man can do good work with poor tools, whether it be in the use of compressed air tools or any other craftsmen's tools. The care of pneumatic tools is one of the great essentials necessary to their efficiency in operation and also to their adequate life.

No two operators use tools alike, nor get absolutely the same results from each tool. All have their likes and dislikes, simply because we are all human. Some will give very close attention to the proper oiling of their "guns," while others will allow loose working parts until the tool becomes jammed and has to be taken off the air to the toolroom for repairs.

Some will crowd a hammer, where others will use precise judgment in its working. Some will allow a hammer to dance continuously on the rivet set, this tending to enlarge the forward end of the barrel, and then wonder why they break so many rivet sets. But the operator is not to blame for all the troubles resulting in the use of pneumatic tools.

Much trouble that could be prevented is caused by the presence of water in the air lines and this is one of the greatest enemies to the proper life of air tools.

Air, under the intense pressure needed, is very hard to hold; therefore, all working parts must be ground to the closest necessary dimensions possible, or the tool loses its efficiency; and while you can compress air, it is almost impossible to compress water within the limited working parts of an air tool and many broken parts result because of too much water in the air lines.

Air tools were designed to use the driest air obtainable, and they cannot be operated by the hydraulic method.

THE California Shipbuilder is a new and unusually bright publication whose editor will have to hustle to keep up to the standard of its initial issues. We are glad to reprint from its second number, September, 1919, the following article by the manager of the Pacific Coast Branch of the Cleveland Pneumatic Tool Co. The advice embodied is correct, but we cannot avoid calling attention to the fact that wet compressed air is not only a possibility but a certainty wherever air is used, and not a special experience of the Pacific Coast, and that there cannot be satisfactorily dry air without the cooling of the air, and the condensation and separation of the moisture before the air reaches the tools.

So, in the care of air tools, we again say that much trouble can be eliminated by providing dry air. In some of the Pacific Coast yards, owing to fog in the Bay district and to the "Oregon and Washington mists" obtaining in the Northwest, many thousands of dollars are lost because of improper engineering in constructing and maintaining the air lines of a ship plant.

Much too little is being done to overcome this, we might say, shipyard disease. Wet air is the cause of much breakage. Dry air is the cause of no breakage. When a tool is operated by wet air and allowed to lie idle for a short while, especially if carelessness in oiling is in evidence, you will find that rust develops to a greater or less degree. We would just as soon be considered foolish for putting a few grains of emery and sand in an air tool as we would attempt to operate it when it is rusty. Rust cuts and air cannot be held where there are scratches or rings made by either emery or rust.

All air hose lines should be blown out to rid them of accumulated condensation before beginning the operation of an air tool, and when not in operation, all air tools, if you wish to get proper life from them, should be submerged in an oil bath. This method especially is necessary in a wet or foggy atmosphere. The practice of allowing the tools to be left over-night where they were last used is very detrimental, because they will collect moisture and will develop rust to a greater or less degree and then maintenance costs grow larger.

The compressed air department of a shipbuilding plant is the most essential department in it, and in the maintenance of air tools the best judgment obtainable should be used. It is important that in all toolrooms the best mechanics obtainable should be employed—men who do not know the use of a caliper, figuratively speaking, but who are experts at reading a micrometer and who work to micrometer dimensions in the grinding and fitting of any parts necessary to be replaced in air tools.

Maintenance costs can be multiplied and quadrupled by inefficient toolroom methods, and every dollar spent unnecessarily is just that much more removed from the profits of any going concern.

Because compressed air is the most expensive means of conveying power, and because pneumatic tools are subjected to such intense vibration constantly, and because the air tool department of a shipbuilding plant is one of the greatest assets in the speedy construction of ships, it would seem important that the best brains obtainable should be used in this department to see that all air tools get the best care possible and that same are properly maintained to their highest degree of efficiency.

WAR-TIME TUNNEL BUILDING ON BAGDAD LINE

ANNOUNCEMENT is made of the completion of the great Taurus tunnels of the Bagdad Railway system. What follows is condensed from despatches to the daily press.

The series of tunnels in the Bagdad Railway, which are properly known as the Taurus tunnels, require about forty minutes to be tranversed by train. Their length is about twelve miles. They cut through a series of massive ranges running in a north-south direction, and are interrupted by a number of gorges of tremendous wildness which are crossed on high bridges.

There are eleven tunnels in the series, and the distance which separates any two of them is not more than 100 yards or so. Altogether the Taurus tunnels form a feat which deserves to rank as one of the greatest pieces of railroad engineering in the world.

It was the irony of events that the Taurus tunnels should have been completed by German and Austrian engineers only two weeks before the Turkish armistice of last October. When the war began engineers were rushed to the Taurus and work was begun on the great system of tunnels which now links up Bozanti and Kara Pounar.

All through the war the work went on, thousands of Armenians, Greeks and British prisoners being driven at top speed until they dropped and died.

Without the tunnels Turkey in Asia is virtually cut off, except by sea, from the vast Ottoman provinces of Syria, Arabia and Mesopotamia. From time immemorial the Taurus Mountains have been an effective barrier against adequate communication between Constantinople and the desert towns.

Before the war, when work on the Chemin de Fer Imperiale Ottoman du Bagdad was begun, the Taurus was crossed by a Decauville, or light railway, which was hopelessly inadequate for the streams of war traffic flowing down toward the Syrian and Mesopotamian fronts.

With plenty of forced labor at hand Austrian engineers chose the most direct line for the Taurus tunnels, despite the fact that much work might have been avoided by a more circuitous route.

It was an added difficulty experienced in driving the tunnels through that the Taurus rock is harder than any which railway engineers have elsewhere had to contend with.

Hundreds of experiments with new rock drills, calculated to speed up the tunnels, were made, but what new devices were effected is not yet known.

Suffice it to say that the tunnels have been driven through, and the line on both sides of the Taurus range had been linked up on the eve of the armistice. The tunnel was finally handed over to the British railroad authorities in an unlined condition but it has since been lined by British Indian labor.

COKING PROCESS PRODUCES VALUES

When one ton of soft coal having a market price of seven dollars per ton is coked in a by-product plant the chief products obtained have the value shown in the following table:

Value of by-products obtained by coking one ton of coal.

Cost of one ton of coal.....	$7.00
One ton of coal produces—	
0.65 ton of coke, worth	6.00
5,000 cubic feet of gas, worth	5.00
Three gallons motor oil, worth	.75
Nine gallons tar, worth	.25
25 pounds ammonium sulphate, worth	1.25
Total value of products	13.25
Less cost of one ton of coal.....	7.00
Increased value	$6.25

The table shows that the products of the coking process have a market value about 90 per cent. greater than the original coal. This increased value is due mainly to the human labor expended in the coking process, because it takes a great variety of labor to plan, build, and operate a by-product plant. High technical skill—that of engineers, chemists, and draftsmen—is required in making the plans for a by-product plant, a large number of skilled and unskilled workmen are needed to erect the plant, and a large number of skilled and unskilled workmen are necessary to supply the material needed in its erection. Skilled and unskilled labor has to distribute to consumers the by-product gas; a large number of technical men, and skilled and unskilled labor is needed to operate the plant; and many chemists are kept busy getting drugs, dyes, paints, and other products out of tars. Therefore, by using coke, employment is given to a large number of men. The increased value of the products represents the labor that has been expended in making these products available.—*Technical Paper 242, Bureau of Mines.*

CROWDING OUT STEAM ENGINES

It is the opinion of many among the more progressive of our engineers, says the *Bulletin de la Société de l'Industrie Minérale,* that the steam engine has had its day. In most of its applications it requires coal of good quality. But such coal is a diminishing quantity. Moreover, there are, waiting to be utilized, vast reserves of fuel of low grade, poor coal, impure lignites, carbonaceous schists, waste from coal screening, and other combustible materials. The motor of the future must be capable of utilizing these, not directly, but indirectly through chemical processes which give by-products that leave the cost of the prepared fuel low. The future seems to be to the internal combustion engine; the gas producer will take the place of the boiler. The discovery of the steam turbine seems, for the time, to have thrown far forward the date of the disappearance of steam power. But inventive minds are at work to find an analogous device for the application of gas. When the gas turbine is an accomplished fact, as it seems likely soon to be, the balance will be tilted in favor of gas, and the internal combustion engine will be master of the situation. Then the low-grade fuels will have found their place in the economy of manufacturing industry.

AN AIR-TIGHT CENSORSHIP

Although more than a year has elapsed since the Central powers were forced to bow to the inevitable, it is only recently that we of the outside world began to realize the extent of the terrors visited upon the helpless Armenians by their Turkish oppressors. During all the time the war was in progress the Ottoman government maintained such a censorship as effectively prevented the world learning of anything like the full extent of the outrages perpetrated upon the Armenian people. By means of the stringent censorship established at every frontier, private communication was severed entirely between Constantinople and the provinces, and the provinces themselves were isolated from one another.

With the lifting of the war-imposed blockade and the return of investigators who have visited the stricken land, it appears that neither Belgium nor Poland, cruelly as they were wronged, suffered anything like the horror and tragedy which fell upon Armenia. Literally millions were slain, enslaved, starved, tortured, robbed of everything they possessed. Today more than a million Armenians, many of them orphan children, are destitute and homeless, without sufficient food or clothing and with no means to procure it.

Herbert Hoover, who knows the needs of all the war-stricken people as no other man knows it, said recently in a message to the Near East Relief, "In my opinion, in the Near East is the most desperate situation in the world."

NAILING THE APPLES

It is quite possible that an active demand may develop for old fashioned cut nails, preferably of the larger sizes, as a result of experiments which have been conducted by fruit growers in the Pacific northwest. A prominent grower in the panhandle of Idaho finds that he is able to increase the yield from his Siberian crab-apple trees nearly 1,000 pounds per tree by driving cut nails into the trunk. Steel nails do not seem to achieve the same results. It is well known that there is some iron in apples and apparently this variety of tree has the ability to dissolve some metal from the nails driven through the bark, forming iron compounds which are utilized in producing the fruit.

Tin is one of the few highly useful metals that are practically not produced in the United States proper. The output of tin from domestic ore in 1918 was only 68 tons, nearly all of it obtained from placers in Alaska. The tin imported in 1918, as metal and in concentrates, amounted to 82,854 short tons, the largest quantity yet brought into the country in any one year.

A writer in a recent issue of *L'Astronomie,* calls attention to a tiny village in Kashmir, which holds the lofty distinction of being the highest on earth. This village, which bears the name Karzok, is located at latitude 32° 58′ 0.90″ North and longitude 78° 18′ 13.95″ East from Greenwich. Its altitude is 4,556 meters or 14,946 feet. The village contains a few wretched stone houses and a small Buddhist monastery.

Subaqueous tunneling operations in New York are now so familiar and go on so constantly as to cause little remark. The second single track tunnel for the Rapid Transit Subway has recently been poled through. Much work is still to be done in enlarging the headings, in lining and equipping, but the critical time is passed. Much of the excavation has been done under a pressure of 39 pounds above atmosphere, in which pressure, under the law, the sand hogs were employed in three hour shifts, eight of these shifts being required to maintain the work continuously through the 24 hours.

THE WAGE

By ALBERT E. HAYES

In *The New York Times.*

"In the sweat of thy brow," the Lord had said,
as He drove the twain from the Gate.
"Thou shalt conquer the earth by hand and
brain and travail early and late."
And Adam looked keen at his wondrous Mate,
who strode with a free-born air.
And the first Man laughed at the doom of his
Lord, for he knew that the wage was fair.

The Spirit of Man that was born that day went
forth with silent pride
To tame the beasts in their savage haunts and
to lay his hand on the tide;
To harness the bolt from the looming clouds
and shrivel both time and space.
To chain the earth in bands of steel and mock
the winds in their race.

Now, lords of the earth and air and sea, in the
smoke of their belching fires,
The Sons of Adam winnow the world for the
meed of their deep desires.
And in heat like hell's are their spirits blent,
and keen are the brands they wield;
From their leaping forge are the engines born
that travel by flood and field.

And the Spirit of Man looks back on the road
that his far-flung breed has trod,
With the sweat of brow that has shaped the
earth from the rugged hand of God,
With the ache of brain that has hewed the
path of Man from his barren lair.
And Man looks still at his wondrous Mate and
knows that the bargain was fair.

And he laughs as he looks in the face of God,
who drove him from Eden's gate,
With the doom of Labor across his brow, when
he wandered forth with his Mate:
And he never will flinch from the toil-tracked
road so long as his guerdon lies
In the laugh of the babe that romps on Her
lap and the lovelight in Her eyes.

Notes of Industry

The tidal power scheme, in which it is proposed to utilize the difference in phase of the tides on the rivers Severn and Mersey, has its counterpart in an interesting plant installed in France. The rivers in France which rise in the Alps are called "glacial" streams, while those that flow through the central part of France are called "Jurassic." The "glacial" streams, as their name implies, are fed from the melting of snow and ice, and consequently have their highest flows in the summer months. The "Jurassic" streams, on the other hand, have their high flows in the spring and the low flows in the summer. One of the larger water power companies, the Compagnie d'Energie Electrique du Litteral Méditerranéen, took advantage of this difference in phase of two rivers and developed and interconnected water power plants on both rivers. The lessening of the need of auxiliary power by this happy combination is very apparent.

In 1913, America imported 270,720 tons of potash salts. Of this total over 99 per cent. came from Germany, and there was no potash industry in the United States. Since then, imports have declined almost to a vanishing point, and during 1918 there were 78 firms engaged upon the production of potash compounds. Their output was 192,587 tons of crude material.

The war scheme for the utilization of old drawings and tracings upon cloth for hospital bandages, etc., seems to have been worked in England quite extensively 53,000 yards of material being recorded, some of it with interesting records. The oldest plans which came to hand were dated 1835 and were for the London and Birmingham Railway. Other plans bore the signatures of leading engineers of their time, and among them was that of Robert Stephenson. One plan was 75 feet long.

According to the *Dry Dock Dial*, the house journal published by the Morse Dry Dock & Repair Company, South Brooklyn, N. Y., a new Ingersoll-Rand steam compressor, to be used as an auxiliary to the two large electric compressors, can deliver air at 100 pounds pressure in the boiler house at the head of Pier 4. The compressor can deliver air to 100 pounds pressure at the rate of 1,000 feet a minute and is used mostly during the night at times when there is no need to operate the larger engines. It is used to increase the output in case of rush times and is an emergency measure should the bigger plant have a mishap. Chief Engineer James Collins expects to increase the size of the boiler room and contemplates adding another steam air-condenser.

Compressed air is used at the Harlem repair yard of the Terminal Railroad Association of St. Louis, in mixing paint. The paints are prepared in barrels, each barrel having a stirring rod, five feet in length, made of three-fourth-inch pipe and fittings. The handle of the rod consists of tee with a pair of short nipples and caps. A second tee, a foot below the handle, forms the point of attachment for the air hose connecting with a pressure line. A globe valve in each lead to the paint barrels, permits adjusting the flow of air through and out of the lower ends of the stirrers in such volumes as may be needed.

A press cable message received from Panama late in November announced that the $661,000 in tolls collected from 196 merchant ships passing through the Panama Canal in the month of October had exceeded those of any previous month, the former high record having been $644,000 for May, 1918.

After resting for two decades on the reefs of the Straits of Magellan, until salvaged and floated in October, 1918, the fine Chilean sailing ship *Alejandrina*, took a cargo of 7,000 bales of wool worth $1,500,000 from Punta Arenas to New York in 92 days. She was placed in drydock at the plant of the Morse Dry Dock & Repair Co., South Brooklyn, scraped and painted and found as sound as a nut. Her great spars were too high to permit of her passing beneath Brooklyn Bridge. Her lofty rigging loomed fantastic, and to the repairers of modern ships she was like a spectre craft, suggesting the old days of pirates and treasure.

The geophone, used during the war to detect tunneling operations of the enemy forces underground, will come into use in practical mining operations. This delicate instrument can detect sounds at a distance of 1,500 feet through solid ground and 1,200 feet in coal. It will be used for the purpose of catching the tapping of entombed miners and noting the distance of drilling operations from a tunnel.

Philip Gorman, a retired locomotive driver, who had been closely identified with the development of the steam locomotive in America, was found dead in his bed recently at the Paris Hotel, New York, where he had made his home for the last twenty years. He retired on a pension from the employ of the Lackawanna Railroad on April 1, 1908, after having served that company and the Morris & Essex railroad for 45 years. Among his effects were found technical journal and newspaper clippings in which his name was used as an authority on steam locomotive development. One article told how the Morris & Essex once had only twelve engines which were under Gorman's personal direction. In those days each locomotive had a name.

The Hollister Mining Company, a subsidiary of the M. A. Hanna Mining Company, has taken over the Judson mine at Crystal Falls, Minn., Superintendent Alfred Martin of the Hollister company now being in charge. The Judson property was idle most of last summer, but the stockpile which accumulated during the years it has been under development has been shipped gradually until but a small part remains. The Amasa-Porter mines, of the Longyear interests, was not included in the deal, at least not for the present. This property produces an entirely different class of ore, and is not a large proposition such as is the Judson. The Hanna interests have a large lot of such a quality of ore at Wakefield. However, it is not improbable that the latter mine will yet pass to the Hanna interests, as the Longyear people are not primarily operators, but explorers and developers.

The Associated Press correspondent at Santiago de Chile reports first shipments of a total of 500,000 tons of nitrate by the Nitrate Producers' Association to England. All of this great quantity of fertilizer will have been delivered by March, adding greatly to Chilean prosperity, as export duties on nitrate comprise an important part of the government's revenues. The first shipments sent up Chilean exchange two points and acted as a tonic on all stocks related to nitrate.

One of the richest gold pockets which has been found on the continent occurred in the Croesus Mine, in northern Ontario, where a yield of about $85,000 per ton was obtained. Six examples of this ore, valued at $10,000, were purchased by the Ontario government.

Dr. Romulo Naon, one-time ambassador of Argentina to the United States, is to be at the head of a financial syndicate, known as the Financial Corporation of Argentina and the United States, formed recently to develop further the financial and economic relations between Argentina and this country.

What is declared to be one of the richest gold discoveries in the Dominion, was recently made by an Indian prospector, Jacob Cook, at a place seventy miles north of The Pas, Manitoba, and east of the Flin Flon copper mine. Pound chunks of quartz, half gold, in string and leaf form, are reported. The vein is six feet wide and outcrops for more than a mile.

The California cactus has enjoyed a state of single blessedness for centuries and has lived and died unto itself, encumbering the ground. Now a big factory is in the course of operation which will manufacture a cattle food highly nutritious, and the prickly usurper must come off the platform of the mutual fight principle and get on the modern platform based on the mutual aid principle. The Cactus Food Products Company of California is going to give this autocrat a merry chase into the lanes of democracy and has secured permission from the Government to harvest the cactus growing on 15,000 acres of land in the Southwest. The by-products are going to be paper pulp, gluten bread, flour and glucose.

Chicago Pneumatic Tool Co. reports that its German subsidiary, which had been seized by the German government and conducted under "compulsory administration" during the period of America's participation in the war, has been returned through the Courts of Commerce.

Compressed Air Magazine

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Devoted to the mechanical arts in general, especially to all useful applications of compressed air and to everything pneumatic.

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PUBLISHERS

WILLIAM LAWRENCE SAUNDERS
President

FRANCIS JUDSON TIETSORT
Editor and General Manager

EUGENE P. MCCRORKEN
Managing Editor

FRANK RICHARDS
Technical Editor

WALTER C. LAROS
Circulation Manager

ARTHUR D. MCAGHON
Secretary

Correspondence invited from engineers, chemists, experimenters, inventors, contractors and all others interested in the applications, practice and development of compressed air. Correspondents and contributors will please submit questions, or matter for publication, accompanied by self-addressed stamped envelope; they also will please preserve copies of drawings or manuscripts as we cannot guarantee to return unavailable contributions in the event of rejection, though our practice is to exercise diligence in doing so.

Editorials

THE SANITY OF OPENING THE GREAT LAKES TO THE SEA

THE UNITED STATES has come to a wholly new stage in the development of its transportation system. The structure by which goods are to be moved from the point of production to the center of distribution, and from the center of distribution to the final consumer is going to be hereafter as different from the present means of transportation as the department store is from the old country store at the crossroads. The difference between the great emporium and the country store is not in the goods on the shelves, nor the methods employed, nor the equipment used —it is a difference in organization.

Transportation also must be organized. We have had the era of the stage coach, the era of the canal boat, the era of the railroads—and now we approach the era of organized transportation.

It is done. The railroads, in gathering all possible transportation business of the country, in competition with waterways, hauling the maximum tonnage a maximum distance at a minimum rate, have suffered an unfortunate physical and financial reaction. Government regulation spared them from the last stages of financial distress in the days of rate cutting, and government operation saved them under the strain of war traffic. When the railroads are returned next month to corporate management it will be under such conditions of law and fact that they will function in proper relation to the national system of transportation as a whole, to the end of giving better public service and receiving higher railroad profit. The law may compel this railroad policy, the facts certainly will.

Organized transportation means that railways and waterways shall serve one another; that each shall play its part in a scientific plan with recognition of the fact that a rail haul is costlier and entitled to a higher rate, not as a competitor, but as merely being correlated to the water haul. Instead of being competitive, or regarded as such, water traffic will be a feeder to railways in addition to being an entirely separate economic factor in transportation, considered as distinctive, let us say, as Zeppelin transports.

For many years the railroads, perhaps naturally enough, were inimical to what they erroneously and unscientifically denoted as water competition, often transporting freight hundreds of miles out of its logical path by water in order to carry it over a longer rail route at a lower rate than even that asked by the water carrier. This was bad alike for railroad, waterway and shipper, because it was a violation of economic law.

But this railway policy which in its fruition resulted in carrying maximum tonnage for a maximum distance at a minimum rate, eventually led to such distressing results that it opened managerial eyes. The more keenly intelligent railroad executives, especially those of financial experience, have undergone a change of heart toward water transport, and there is now a very well-founded conception that it is much better to let freight which logically should go by water take such routes without going after it, and that the rail routes should confine themselves to the more profitable overland freights.

The great trans-continental systems are beginning to see that this will obviate distressing car shortages, hopelessly clogged yards and generally bad service, while it will pay in increased profits.

Our waterways are largely unused, largely unimproved; in one startling instance not even open to traffic. Perhaps the most amazing exhibit in America of national indifference to waterways is seen in that situation where the greatest inland water traffic in the world is separated by only a trifling barrier from all the commerce of the seven seas—and we have let it be. This is the Great Lakes-St. Lawrence Highway,—open for a thousand miles from the heart of the continent to its eastern border, open for a thousand miles from the capes to the head of tidewater, frustrated "by a short stretch of tumbling rapids in the St. Lawrence."

There is no greater tonnage anywhere than the seventy to ninety million tons a year passing through the Soo Canal. There are few water thoroughfares with traffic as dense as that of the Detroit River. There is nowhere else in the world such a tide of tonnage setting toward the sea as there is from our Middle-West down the Great Lakes—halted by Niagara and by the riffles in the river.

It is this tonnage from the lakes, especially the seasonal movement of grain rolling ashore at Buffalo, which makes impossible any solution of the transportation problem by railroad development alone. All through the war and for ten years before the war, railroad experience has been a continuous struggle against blockades alternating with surrenders to embargo. The congestion begins almost invariably at the eastern terminals or is thrown back upon intermediate gateways by the effort to keep the terminals clear. Under what we have come to regard as normal traffic conditions, there is permanent congestion as far west as Ohio.

The remedy for this situation lies clearly in organizing a national transportation system. Enlarged terminal facilities would help, but that would not lighten the problem of railroad finance; it would complicate it. Additional equipment will be necessary but that contributes nothing toward easing the congestion; in a rush of traffic it is more apt to increase it. In fact there has probably never been a time that there were not cars enough to handle the traffic if they could be kept moving. Organization of a national transportation system in this instance would mean that the Great Lakes Highway was continued to the sea, that the eastern railroads were relieved of their crushing overload, that their peak load caused by the seasonal movement of grain was reduced, that their equipment needs were brought down to what can be reasonably provided, and that production would bear the cost of getting to market by the logical route, which is the cheapest.

In every part of the United States there are waterways capable of better development and higher utilization. The international commercial delegates wept when they saw the Mississippi idling to the sea. They would have been shocked if they had seen the Great Lakes Highway open at both ends, and with only small obstructions to prevent the use of the entire course.

Water-borne commerce has in times past, and will in the future so long as natural forces prevail, cost one-sixth to one-seventh as much as transportation by rail. That is the historic relation, rates follow costs. On the Great Lakes transportation is even cheaper, running down to one-tenth of the rail rate for the movement of bulk commodities. With nearly one thousand miles of clear sailing through the lakes it pays handsomely to remove the obstructions. The total cost of all the improvements at the Soo, for example, is thirty-two million dollars. The movement of tonnage through the Soo in 1918 was ninety million tons. If water carriage saved as little as ten cents per hundred, the improvements at the Soo paid for themselves five times over during the season of 1918.

Opening the St. Lawrence route will make certain savings in the cost of moving goods to market; it will add to the productive capacity of the middle and further west, brought by this means a thousand miles nearer the world's market, and from the standpoint of organized transportation it will relieve the railroads of an impossible financial problem through an outlay estimated at $110,000,000 or approximately two per cent of the sum which we are told must be spent for railroad better-

ments, and that largely for equipment and terminal improvements to relieve the congestion.

Applying this same principle throughout the United States, using railroads and waterways alike as instruments to serve traffic, instead of employing traffic as a means for the nourishment of railroads, it is hardly doubtful that the transportation business will thrive better. It is certainly not to be doubted that with the transportation system coördinated as a whole the production and consumption of the nation will be better served.

FREDERICK ALFRED BRAINERD

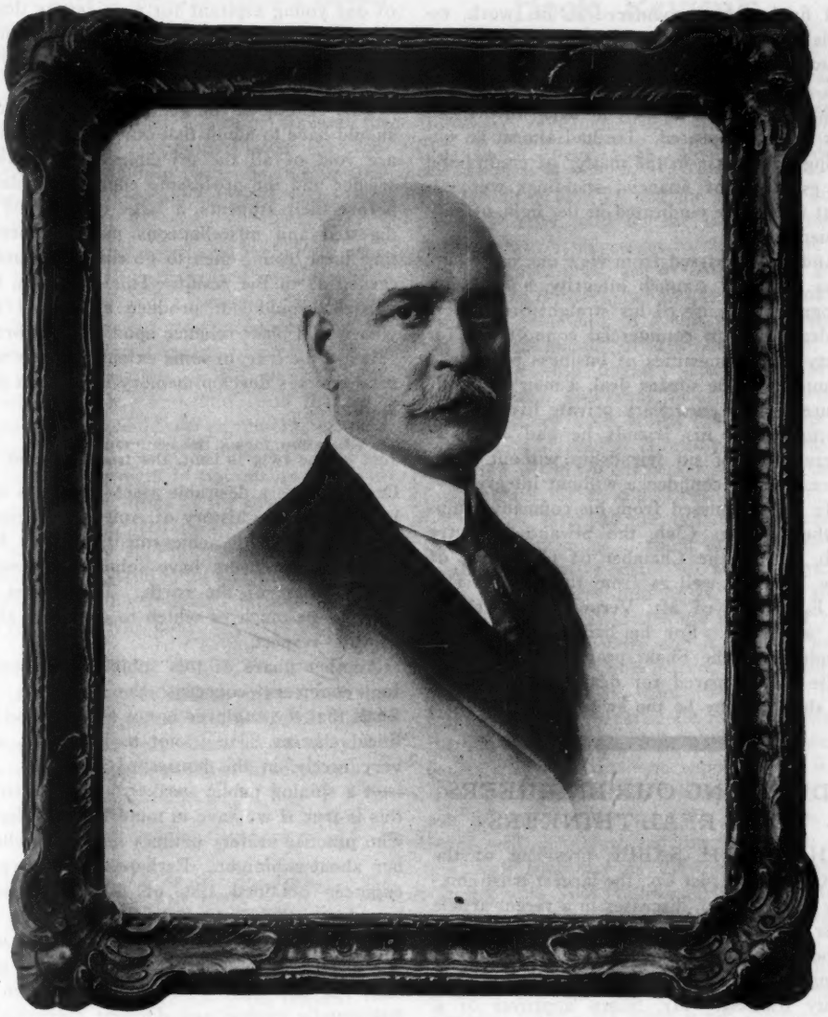
A GENIAL and interesting business figure in the air-compressing and mining machinery world, Mr. FREDERICK ALFRED BRAINERD, who was Vice-President, Secretary and a director of the Ingersoll-Rand Company and Secretary of the A. S. Cameron Steam Pump Works, of No. 11, Broadway, New York, passed away just a week before Christmas day, at the age of 58, sincerely mourned by a host of devoted friends and old-time business associates. The announcement of his demise at his home, No. 274 Summitt Avenue, Chester Hill, Mt. Vernon, N. Y., was received with expressions of genuine sorrow and sincere regret in the offices of the machinery district of lower Manhattan. It brought a distinct sense of loss to his fellow officers of the Ingersoll-Rand and Cameron Companies, among whom were numbered close friends.

His death, despite a long illness, was a shock to the surviving members of his family: his widow, Mrs. MARY E. BRAINERD; a son, HOWARD S. BRAINERD; a daughter, Mrs. FRANK GORMAN; and his two sisters, the Misses EMMA T. and LAURA A. BRAINERD. Mr. BRAINERD had been born and reared in Brooklyn, the son of CHARLES HENRY and MARIETTA SOPHIA BRAINERD. His father had been a member of the prominent Connecticut family of that name, who were among the early settlers in the American Colonies.

A man of traits of firmness and decision of character, manifestations of which had promoted his success in business life, he was known also for his integrity and for his fairness. He had confidence, too, in the fairness of others in business dealings and believed in the policy of "giving the other fellow a chance." At the same time he was a credits authority and a student of the financial standings of buying concerns and the purchasing possibilities of regular customers, and maintained an attitude of cautious reserve that not infrequently reacted as favorably for the buyer as for the seller.

His idea of settling a difficulty was a face-to-face understanding, rather than attempting decisions on half-truths and fragmentary facts. The importance of this trait in his character may be gauged when it is considered that in the course of the years of his active business career he passed on the granting of credits involving hundreds of millions of dollars.

One of his friends said of him that in his business practice he had more than an inkling of the spirit of HENRY VAN DYKE, when he wrote: "There are two good rules which ought to be written in every heart: Never believe anything bad about anybody unless you positively know it is true; never tell even that, unless you feel it is absolutely necessary, and that God is listening while you tell it."



FREDERICK ALFRED BRAINERD

The various steps in Mr. BRAINERD's career, from the time of his modest beginnings 33 years ago as an assistant in the accounting department of the business of ADDISON C. and JASPER R. RAND, styled the Rand Drill Company, with offices at No. 23, Park Place, New York, down to the time of his demise, was contemporaneous really with the greatest advancement of the whole compressed air machinery industry. In his lifetime he had witnessed the progress made in development of America's resources in metals and likewise those engineering achievements that have so transformed modern economic conditions. Mr. BRAINERD, with his associates, kept an appreciative and receptive mind, as well as a watchful eye, on the requirements of all the great industries, not only of America, but of the world, with respect to compressed air equipment, while meantime his business functions and responsibilities were growing.

He remained at his post with the Rand Drill Company until after the deaths of the two RAND brothers, when he became a director and the treasurer of the company. At this period, some twenty years ago, JASPER R. RAND, the younger, had succeeded to the presidency of the organization. It was five years later, in 1905, that the Rand Drill Company was merged with the Ingersoll-Sergeant Drill Company.

Mr. BRAINERD had considerable valuable experience of granting credits before he took up that phase of activity with the Rand Drill Company, for he had acted in similar capacity for other large concerns. Even at that day he had the reputation of having reduced losses to a minimum percentage, for in transactions aggregating more than a million, which was accounted a very large turnover in that day of simpler business, bills of only a few thousand dollars on which he had passed remained uncollected. And up to the end of his days of business he continued to exercise a rare judgment in the analyzing of credit transactions.

After Mr. BRAINERD came into the Ingersoll-Rand organization, there was for a time a natural disposition on the part of Ingersoll salesmen to question occasional judgments of his on the soundness of customer credits, but the day came when his rulings were accepted as law,

and final. He encountered in his work, especially in his earlier years with the Ingersoll-Rand Company, that good-natured antagonism and opposition which so frequently prevails between the sales and credit departments, but this soon disappeared. He had almost an unerring fifth sense in the matter of credits and his estimates of financial standings were almost invariably vindicated in the light of subsequent events.

And so has passed from view one more business figure of staunch integrity, a character recognized because of his straightforwardness in dealings with commercial connections, for nicety in the amenities of business practice, a champion of the square deal, a man of kindly nature and of exemplary private life. In his relations with his friends he had felt that "there could be no friendship without confidence, and no confidence without integrity."

He will be missed from his companionships in the Lawyers Club, the Siwanoy Country Club, and in the Chamber of Commerce of New York, as well as from the Chester Hill M. E. Church of Mt. Vernon, of which he was a trustee. For he had recognized the soundness of the Shakespearian truism:

"Be still prepared for death, and death or life shall thereby be the sweeter." F. J. T.

EDUCATING OUR ENGINEERS TO BE REAL THINKERS

CHARLES H. SABIN, president of the Guaranty Trust Co., the largest trust company in the world, discusses in a recent article under the title, *The College Man*, in *Collier's*, the best way for a young man to spend his time during the years ordinarily devoted to a university training. Mr. SABIN approves of a university training for every young man, and disposes of the old fashioned, prevalent and mistaken notion regarding the attitude of university men toward the world in general, by saying "I do not find anything in the stereotyped objection to the college graduate as a young man who thinks he knows it all. I do not find them conceited or objectionable."

Mr. SABIN, in his discussion, sounds the predominant note that "every employer is looking for the man who not only can but will think. One can hire any number of people marvelously skilled in routine or in detail—human machines that will run splendidly as long as motive power is supplied and nothing unusual turns up in the work."

This statement may stimulate thoughts regarding the perfection of the average engineering curriculum as a factor in the success of many a distinguished alumnus. Education is ordinarily supposed to be a trite subject, but is our present engineering education calculated to produce a man who can and will think? Suppose the technical man remembers his university training as one great mass of facts, figures, scientific principles applied to various practical operations and a little pure science thrown in, most of which he was supposed to possess before beginning his professional course—all to be assimilated within four years. The thought suggests the conclusion of one young aspirant for a university degree, who, near the end of his senior year, summed up his experience thus: "It took four years to get in, and four to get out."

This cannot be the general sentiment or we should have to admit that our technical schools are void of all the principles of educational science and the professors engaged in placing before their students, a large quantity of undigested and miscellaneous material, permitting these young men to go their way unconcerned as to the result. This condition, if it existed, would not produce a type of man who would place reliance upon his own brains.

It may be true, to some extent, that our technical courses develop memory more than originality.

Tis education forms the common mind:
Just as the twig is bent, the tree's inclined.

Originality is a desirable asset. Problems must be solved. The history of American engineering is filled with achievements in this field. American engineers have solved problems in every corner of the earth. There does not seem to be much of which to complain about in this respect.

Another phase of this subject of education for engineers concerns the assertion put forth that the engineer is not a social and political success. He is not to be found, save very rarely, in the houses of Congress. He isn't a shining public speaker. Comparatively, this is true if we have in mind the legal lights, who practice oratory betimes in the bed chamber about midnight. Perhaps, if our typical engineer obtained less of the very useful knowledge that he customarily possesses, but more ability to decorate every occasion with his spoken views, these would be more popular, but not more deserved, appreciation of this usually modest and diffident individual.

LOCATION OF DRILL HOLES EFFECTED BY GEOLOGY

AT A RECENT dinner of the New York Section of the American Institute of Mining and Metallurgical Engineers, Mr. ALBERT BROKAW, a member of that fortunate class these days, the petroleum geologists, casually suggested a unique classification of oil companies. Mr. BROKAW said there were three classes: Companies which drill with, those that drill without and those that drill against geological advice.

There were notable examples in each class, but, more recently, the majority were in the with-geological-advice class. For this we are all gratified. Everyone should wish to uphold so distinguished a body of scientific investigators, and it is with a sense of the fitness of things, that we find their efforts justified by practical results.

When oil was discovered sixty years ago in Pennsylvania, the southwest was apparently not considered. Nobody had visions of great fields in Texas, Oklahoma, and, more recently, Wyoming. Now come more rumors from Montana.

We were recently much interested in a computation by an accredited member of the United States Geological Survey showing the oil resources of the United States. This scientist estimates that the quantity of oil underground in this country will last, at the present rate of consumption, for about sixteen years. The information is most interesting, and we must bow in recognition of the erudition of a member of our community who can tell us all about conditions down in the earth's depths. However, we have also seen estimates of 30 years' supply. Whatever may be the truth of the matter, we admit our own ignorance, but are firmly convinced of the utility of the geologist and we are also deeply interested in all things geological. As for geologists—may their tribe increase!"

MOIST AIR AND GETTING HEAT OUT OF COAL

A GENTLEMAN living at Mt. Vernon, N. Y., signing himself "Observer," wrote to the editor of *The New York Sun* some interesting remarks on saving coal, with particular reference to the proper use of dampers and to keeping the air moist. His seasonable sentiments in winter weather are based on the circumstance that with every shortage of fuel comes regularly the undertaking of getting more heat out of the coal than the coal contains! These schemes vary in detail, but all contain the essential features of mixing the coal with ashes and salt. The gentleman in question noted that a dozen years ago he tried out several of such recipes, measuring the heat produced, and he found it hardly necessary to add that no measurable gain in the number of heat units was perceptible.

The heating power of coal depends on the amount of carbon, free and combined, that it contains. When the carbon is oxidized the heat of combustion becomes sensible and measurable. Commonly it is expressed as British thermal units, sometimes in calories.

The British thermal unit is the weight of water that will be raised one degree in temperature by the burning of one pound of coal. Ordinarily the coals of commerce vary from 13,500 to 14,500 units in fuel value. Once upon a time a school board ordered its supply committee to purchase no coal under 17,000 units. As a matter of fact coal of so high fuel value does not exist.

The salt and ashes mixture add no heat units to coal. There may be a slight prevention of loss in the combustion, which could be regulated much better by the proper use of pipe and draft dampers, and the skilful use of these is the secret of economical heating. The coal should burn at such a rate that the heat from the radiators balances the heat lost. In other words, it is the steady and uniform combustion of a determined weight in an hour, the amount depending partly on the temperature and wind out of doors, but mainly on the humidity of the air indoors.

Moist air retains its heat far better than dry air, "Observer" goes on to say. By keeping the humidity of the room at about 60 per cent the saving of fuel is very material and there is a marked improvement in bodily comfort. Dr. Winslow once asserted that the air

of schoolrooms is as dry as that of a desert. In this the doctor was dead wrong. For the greater part schoolroom air in winter is much drier than desert air. In the Gila desert the moisture content of the air averages about 38 per cent; in many schoolrooms it is as low as 28 per cent.

But if one desires to conserve, skilful dampering and moist air are infinitely more serviceable than chemical treatment of the fuel.

COMPRESSING OF LIQUIDS?—SURE, ASK THE AD MAN

A LEADING manufacturer of air compressing machinery was solicited for advertising by a trade paper serving the dyeing industry, in a letter basing its argument on the following paragraph:

"A great number of your machines, especially compressors, are in constant use in the dye houses, bleacheries, finishing departments and print shops of the textile industry. *Large quantities of liquids must be compressed* in all these departments and dependable machinery of this character is always in great demand."

The engineering staff of the manufacturing concern at first advised the advertising department to look beyond a mere advertising opportunity, for here seemed to lie the germ of a great business idea, provided the writer of the letter could be induced to part with more exact information on how to compress liquids. It was conceived that it might be profitable to employ such a process in the bottling business, for wouldn't there be a healthy conservation of glass if a quart of grape juice could be shipped in a pint bottle? Shipping charges would be lessened and what a boon it would be to the overworked railroads!

But the idea died right there. Sober second thought pointed to the conclusion that what the advertising man had had in mind was the use of compressed air as a conveyor and sprayer of liquids, and not a means of compressing them.

EXCESSIVE EXAGGERATION BY MEANS OF A MICROSCOPE

THE CRESCOGRAPH is a most extraordinary invention of a supermicroscope, for magnifying the highest powers of the present microscope some 100,000 times, which is practically unlimited exaggeration. Its usefulness will be great, for its magnifying potentialities are under complete control and may be reversed into diminutions, it is stated.

The inventor, Sir JAGADIS CHANDRA BOSE, an East Indian savant who has been visiting in London, demonstrated his astonishing device before a highly interested gathering of prominent Britishers, among whom was Mr. A. J. BALFOUR, who warmly commended the lecturer's achievement. The demonstration was upon a growing plant. It is estimated that the average rate of growth in plants is one-hundred-thousandth of an inch per second. The crescograph at first showed the plant growing at such a speed that it was indistinct to the vision, though the speed was regulated later to meet the visionary capacity of the spectators.

We note as a standard of comparison that a fifteen-inch gun on the superdreadnought *Queen Elizabeth* threw a shell with a muzzle velocity of 8,500,000 feet per hour, whereas the progress of the common snail under the crescograph's capacity would be at the rate of 200,000,000 feet per hour, or 24 times faster than the shell.

The crescograph instrument includes a magnetic lever, a delicately poised needle, a mirtor, a spotlight, and a screen. Sir JAGADIS says his instrument was produced for the purpose of finding a means of measuring the most intense activities of life, which are often imperceptible. It would seem that such an instrument would be extremely useful if adapted to the study of intellectual, scientific and economic growth in nations and individuals. The possibilities of the instrument have not yet been inquired into intimately, but at first glance they appear to be startling. Who knows but the stability of the world may yet be reckoned and maintained through the wisdom of the ancient East?

A new process for making high speed steel without the introduction of tungsten, molybdenum, cobalt or vanadium as an alloy, has been developed and patented in England.

Contents for February

Book Reviews

HOW TO WRITE BUSINESS LETTERS, Edited by Walter K. Smart, Ph. D., head of the Department of English of Armour Institute of Technology and lecturer on business correspondence in the School of Commerce of Northwestern University, in collaboration with the editorial staff of *System*. Ninth printing. 160 pages and indexed. Price, $1.35. New York, Chicago and London: Messrs. A. W. Shaw Company.

THE CONTENTS and the style of a business letter, and by the latter we mean both the way it expresses its thought, and its physical appearance, are of course what govern its effectiveness, but despite so obvious a truth, the great bulk of business letter writers pay no great amount of attention to either. If every man who dictates letters and every young woman who takes dictation would only read the Shaw book which lies before us on our desk, and read it carefully, even prayerfully, the world of business would be a more joyous place for all concerned.

The book is by no means new—the present is its ninth printing in about three years—but to the appreciative soul into whose hands it falls for the first time it is nothing short of a revelation. It invites the writing of redblooded business letters and it helps to make the whole world your market. It is full of constructive material, and its analysis portrays vividly the essential elements of successful but conservative selling correspondence. It makes the point that one should never write what he would not say verbally to the person addressed. We must be human in our letter writing. How can one be human and use such banalities as "We beg to advise," "In reply to your valued favor, would say," "Hoping to hear from you soon, we beg to remain?"

Why in the world do we so often "advise" a man; why not "inform" or "tell" him occasionally? Not every letter is an "esteemed" or "valued" favor; nor is every order "kind." Why in the name of common sense should we not just "receive" a letter once in awhile, instead of having it "come to hand?" And isn't it infinitely better to say January or February 3rd, than to write it the 3rd inst. or ult.? And will not the reply indicate whether the contents really were "carefully noted?"

The book properly tells us to avoid worn-out phraseology that has become meaningless and suggests that we *talk* business through the mail. We must get a new way of expressing the old ideas. Let us send original distinctive and *personal* messages to our business connections.

We swear that our own stenographers shall read this book for the sake of its suggestions regarding letter forms, spacing, neatness and accuracy. Why, the first estimate a business man makes of an unknown correspondent is based on the appearance of his letter. And, dear girls, if all the accepted details in the mechanical production of a business letter have been carefully observed, its effect may be destroyed by carelessness. A conspicuous erasure, a blot, a smudge or finger mark nullifies the impression that is created by an otherwise perfect page.

Sales manager folk and their assistants indoors should absorb and retain the elements

of selling by mail contained in this extraordinary volume. The principles taught are worth many thousands of dollars to any progressive house.

STEEL AND ITS HEAT TREATMENT, by Denison K. Bullens, Consulting Metallurgist. Price, $4 net; 6x9; 483 pages; illustrated. New York: Messrs. John Wiley & Sons, Inc. London: Messrs. Chapman & Hall, Ltd.

IN THIS edition the scope of the work has been broadened to include additional information of a practical nature to illustrate further the application of principles in everyday commercial practice, and to encourage a consideration of every element in the cycle of operation from the initial heating of the steel for forging to the cooling in the final heat-treatment process.

In the section on Heat, additional data are given to illustrate the difference between combustion and generation of heat and the application of heat to useful work; the difference between the mere indication of uniform temperature and uniformly heated products; the relation between temperature, time, mass, and surface in the determination of uniformly heated products, etc.; and the factors governing the selection of furnaces and fuels, and the use of both.

The section on Forging has been materially enlarged to illustrate the relation of forging to heat-treatment, the effect of temperature, time and uniformity of heating upon the structure of steel, together with original photomicrographs illustrating the variation in structure under distinctive conditions.

PENNSYLVANIA PROGRESS—Published by the Pennsylvania State Chamber of Commerce, Harrisburg, Pa. Alba B. Johnson, president; Robert Haight, editor. Vol. 1, No. 1, November 25, 1919.

THE EDITORIAL announcement says that this first issue will be followed by others from time to time; regularity of publication being governed by the importance of the subject matter. Succeeding issues will be devoted to discussing industrial problems and civic questions of interest to Pennsylvanians.

The first issue contains a feature article on the new home of the Chamber of Commerce of the United States by Harry A. Wheeler, former president of the national chamber, and the remaining pages are devoted to setting forth the duties and functions of the various departments of the state chamber. The initial issue bears promise of a useful future for such a publication, which will be an invaluable aid in coördinating the different elements seeking to stimulate the industrial progress of Pennsylvania.

BLASTERS' HANDBOOK—E. I. Du Pont de Nemours & Company, Wilmington, Delaware. Illustrated with drawings of blasting equipment charts of technical data, and sketches of subsurface conditions where various kinds of explosives are used.

THE WELL KNOWN Du Pont Company, the leader in the manufacture of explosives for many years has given in this book a considerable amount of handy information for various uses of explosives. It does not go into exhaustive detail in many cases, but cites references to other publications of the company which can be procured free of cost.

The handbook is valuable for its pages containing the technology of the subject of explosives in general. The standard methods of performing each operation, including priming, the loading of large and small holes, of varying depths, using blasting machines, tamping, thawing dynamite and the handling and storing of explosives are discussed. Several pages are devoted to bore holes and rock drills, while road building is also described. A number of miscellaneous uses for explosives are given including the blasting of stumps, ice gorges, frozen material in railroad cars, scrapping heavy machinery, cleaning out smokestacks and starting rafts or jams of logs.

Coal and metal mining and submarine blasting are given prominence and particular problems in these fields are covered in detail with accompanying illustrations. This book is entirely practical in its treatment of the subject and the brevity used in the presentation of the matter contained are strong recommendations for having it conveniently at hand when such information is required. It should have a wide distribution among users of explosives.

GRANITE MARBLE AND BRONZE WEEKLY BULLETIN—Edited and managed by George R. Ford. Published every Monday by the A. M. Hunt Co., No. 127 Federal Street, Boston, Mass. Price, $48 the year.

TO PROVIDE prompt circulation of information valuable for business purposes to advertisers in the monthly, *Granite, Marble & Bronze*, the publishers have decided to issue a weekly bulletin, the first issue of which has recently made its appearance. The service is intended to remedy the defect now existing of having to withhold current business news, for publication at monthly intervals, which has proved a decided handicap in the presence of aggressive competitive methods of modern business. The new publication is for the exclusive use of the advertisers in the monthly magazine and the editors purpose to inform their subscribers regarding developments in their particular fields which will result in sales of each manufacturers' product.

The service will be continued permanently providing it meets with general approval, and the editor modestly invites criticism when necessary and requests suggestions for improvements.

Personal Intelligence

Joseph W. Roe, formerly assistant professor of mechanical engineering at Sheffield Scientific School, Yale University, New Haven, Conn., has been appointed secretary to Dr. W. F. M. Goss, president of the Railroad Car Manufacturers' Association.

* * *

Mr. L. D. Knight, formerly manager of the Ingersoll-Rand Co.'s Houghton office, has been appointed manager of the company's office at Butte, Mont. Mr. E. J. Coughlin, who has been acting manager of the Butte office has been transferred to the El Paso territory as a special salesman on important drill work to relieve Mr. O. H. Sellars. Mr. Sellars has been appointed sub-manager of the Mexico City office, which operates under the direction of Mr. J. D. Foster in El Paso. Mr. Stacy H. Hill, manager of the Duluth office has taken over the Michigan copper district, the iron and copper territories being merged, with an assistant district manager stationed in the Houghton office.

* * *

William M. Corse has resigned his position as technical superintendent of the Ohio Brass Company and accepted a position as general manager of the Monel Metal Products Corporation of Bayonne, N. J. Mr. Corse has had extensive experience in special alloy development work. The Monel Metal Products Corporation was formerly known as the Bayonne Casting Company. They manufacture all forms of monel metal and aluminum bronze.

* * *

Gardner Pattison, of New York, has been appointed vice president of the United States Distributing Corporation, of New York, to assist George F. Getz, president. Mr. Pattison is one of the prominent figures in the coal trade in the East. He is now chairman of the board of directors of William Farrel & Son; he is best known as one of the firm of the late Pattison & Bowns Co. During the war he devoted a great deal of his time, unofficially, to the Fuel Administration.

* * *

A. G. White, who has served for a number of years as the economist for the Bureau of Mines, has resigned to accept a professorship with the University of Pennsylvania. He will serve as an instructor in economics as applied to business.

* * *

Glenn G. Allen, recently in the service of the Government, has accepted the office of secretary-treasurer for the American Portland Cement Co., newly formed, with headquarters at 906 A. O. U. W. building, Little Rock, Ark.

* * *

L. L. Piersall, of the Kentucky State Road Department, has been appointed chief engineer in charge of the construction of the Ohio River Federal-aid road from Louisville to Paducah. Prior to becoming a state employee, Mr. Piersall was a road engineer with the Louisville & Nashville Railroad Company.

* * *

E. L. Grant, assistant district engineer, United States Geological Survey, has resigned to become a member of the faculty of Montana College of Agriculture and Mechanic Arts at Bozeman. Mr. Grant has been located at Topeka, Kan., since last April.

* * *

I. F. Baker of the Westinghouse Electric International Co., who has been in the New York office for the last two years, left in December for Tokio, Japan, where he will act as special representative of the company.

* * *

Russell W. Stovel, formerly a Lieutenant Colonel of engineers in the U. S. army, has been appointed a consulting engineer of Westinghouse, Church Kerr & Co., Inc., of New York City. Mr. Stovel has had quite a comprehensive experience in the mechanical and electrical problems connected with central

power station and steam railroad electrification. He had charge of the Paoli and Chestnut Hill electrifications of the Pennsylvania R. R. and the Elkhorn grade electrification of the Norfolk & Western R. R.

* * *

Henry W. Hodge, former Public Service Commissioner of the First District of New York and one of the foremost American engineers in bridge building, died on December 21st, in New York City. During the was, he was attached to General Pershing's staff in France as Director of Military Railroads and Bridges with the American Expeditionary Forces. He was engaged in the construction of a system of docks at various ports and railroads leading from American bases toward the front.

While in civil life, Mr. Hodge designed the Mississippi River bridge, the Great Northern Railroad bridge at St. Louis, the Chicago, Rock Island and Pacific bridge at Duluth and numerous other bridges in various parts of the country. He supervised the construction of some of the largest buildings in New York City, including the Woolworth, the Singer, the Banker's Trust and the Cunard Building now under construction. Mr. Hodge was also engineer for the City of New York in charge of the construction of several important civic improvements. He was a member of a number of American, British and Canadian engineering societies.

* * *

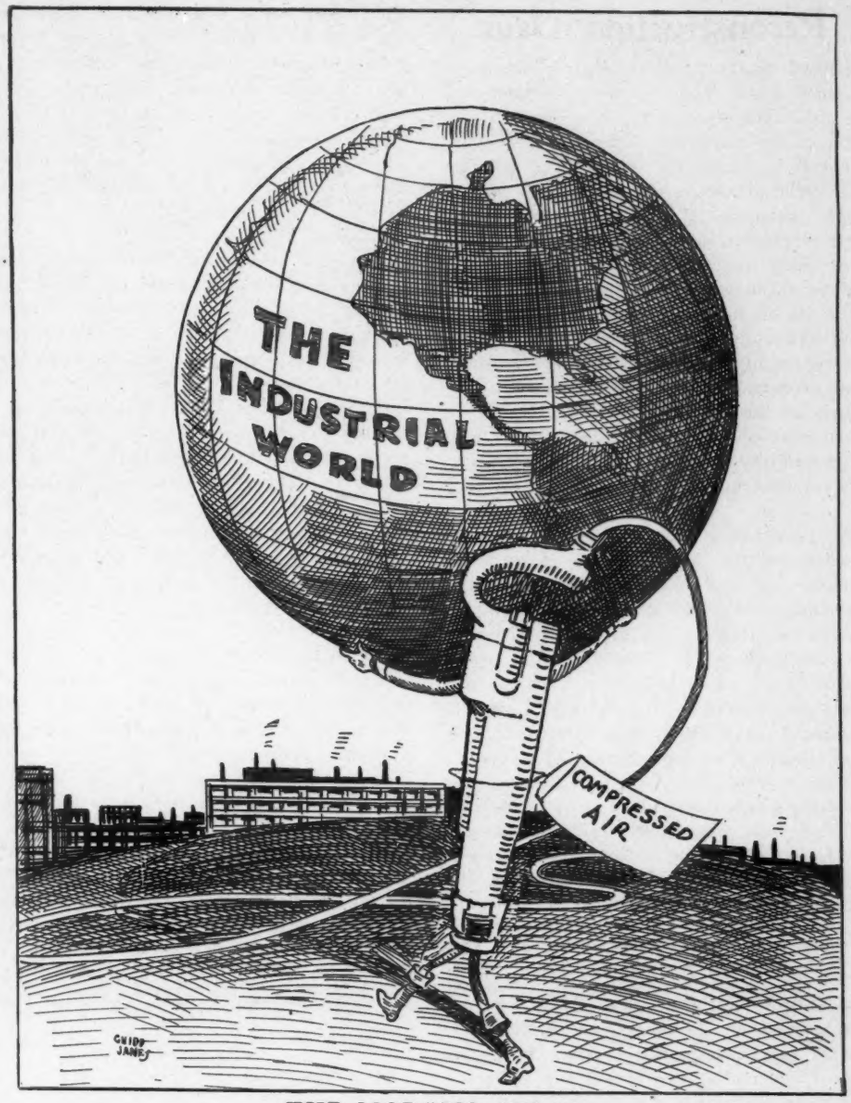
Louis V. Pirsson, professor of geology in Sheffield Scientific School, Yale University, who died recently at New Haven, Conn., had held the chair of physical geology since 1897, and during the same period had been editor of *The American Journal of Science*. He was a member of many scientific societies and the author of a number of text books. Professor Pirsson was born in New York City in 1860.

* * *

S. P. Brown, until recently connected with Ford, Bacon & Davis, a contracting firm in New York, was drowned when he broke through the ice on Sebec Lake, Dover, Maine. Mr. Brown was born in 1877, and graduated from Massachusetts Institute of Technology in 1900. Mr. Brown was chief engineer of the Mount Royal Tunnel and Terminal Co., Ltd., having charge of both the design and construction of the terminal development in Montreal for the Canadian Northern Railway. Prior to this engagement, he was general superintendent on the cross-town section of the Pennsylvania R. R. tunnel under New York. Mr. Brown was a member of the American Society of Civil Engineers, American Society of Mechanical Engineers, Canadian Society of Civil Engineers, Institution of Civil Engineers (British), and American Railway Engineering Association.

* * *

Sir John Jackson, a noted civil engineer and prominent as a contractor for public works in various parts of the world died in London in December. Among the great projects in which he aided were the Manchester Ship Canal, the railway across the Andes to LaPaz, Bolivia, the great barrage across the Euphrates River, near Babylon, the Mesopotamia irrigation works and harbor work in Canada, South Africa, Singapore and other places. He was born in 1851 and created a knight in 1895.



THE MODERN ATLAS

* * *

Captain Sir John Alcock, pilot of the Vickers-Vimy bomber, which made the first non-stop airplane flight across the Atlantic on June 14-15 last, died on December 19 from injuries sustained the day before, when he crashed to the ground in his hydroplane near Cottevrard, Normandy. Captain Alcock was born in Manchester, England, in 1892, and had been flying since 1912. He was the first man to bomb Constantinople on the night of Sept. 3, 1917.

The cost of strikes since January 1, 1919, in the shipping industry is estimated by the United States Shipping Board to have amounted to $37,000,000. This includes marine and harbor strikes, longshore strikes and ship yard strikes, but the results of the coal strike are not included. Also losses incurred by foreign or privately operated American vessels or indirect losses to the public on account of the interruption of regular movement of shipping are not included. Among such indirect losses are those owing to congestion in port and on inland transportation systems resulting in the spoilage of perishable cargo and delays in delivering food supplies needed in the United States and Europe.

Figures of the Standard Oil Co. of California show oil production in California for November amounted to 270,339 barrels a day, a decrease of 7,250 barrels daily from October output. November shipments amounted to 298,939 barrels daily, a decrease of 7,121 barrels a day compared with October. Total shipments were 8,968,162 barrels. Stocks show a decrease of 858,007 barrels compared with October, amounting to 31,159,030 barrels.

James E. Duncan, a retail monument dealer, No. 280, Elm Street, Everett, Mass., is installing a new compressor and otherwise increasing his plant to provide greater polishing facilities.

Reconstruction Days

United States Shipping Board has issued its third annual report for the year ended June 30, 1919. The report is a comprehensive statement of the activities of the shipping board, particularly during the period since the signing of the armistice, which caused numerous sudden changes and in many matters, a complete reversal of policy and methods. The report, which appears as a bound volume containing 213 pages, deals with the board's functions, its organization, relations with various government departments and other bureaus, the return of requisitioned tonnages, foreign trade, construction work and numerous other phases of the work. Much valuable data is given in tabular form and charts are included to graphically illustrate the achievements of this organization.

A remarkable stevedoring job recently handled by the Mediterranean Stevedoring Company of New York, was the loading of the steamer *War Thistle,* of 8,200 tons, for Alexandria, Egypt. The net measurement of the vessel was 304,913 cubic feet and it was loaded with 40 Baldwin locomotives, disassembled, weighing 110 tons each, 1,200 tons of milk in cases, and various automobile parts amounting to a total of 385,000 cubic feet. It was necessary to load a part of the cargo on the deck, which disposed of 40,000 cubic feet, while the milk was stowed inside the locomotive boilers and in similar spaces. The vessel was made ready for sea within two weeks' time, with two gangs working and two hours per day overtime.

President Wilson issued a proclamation on Dec. 24 ordering the return of the railroads to their owners on March 1, 1920. Accompanying the proclamation was a statement by Joseph P. Tumulty, the president's secretary, which set forth that the railroad legislation had not yet been enacted in Congress and that the railroad and express systems were not at present in proper financial condition to be restored. The proclamation authorizes and directs Walker D. Hines, Director General of Railroads to adjust all matters including the making of agreements for compensation and all questions and disputes arising out of or incident to Federal control of the rails.

According to a report published in *Ships and Shipping,* a French salvage company headed by Baron E. de Wardner, who is now in this country, will attempt to raise the *Lusitania,* which was torpedoed off the Irish coast by a German submarine. Soundings have been made around the ship, which lies in about 300 feet of water, and her position has been buoyed. The company expects that the work of salvaging the ship will require about twenty months.

The Chamber of Commerce of Ft. Worth has announced that the Texas and Oklahoma oil fields will soon have an aerial passenger service. Six oil men of Ft. Worth and vicinity have ordered airplanes from the Ft. Worth Aerial Transportation Co. Landing fields have been secured at San Antonio, Tex., Ardmore, Okla., and Jefferson City, Mo. Regular passenger service to the oil towns will be maintained as soon as the new planes arrive and later, service will be established to other points. The machines are of the Curtiss J. N. 4 type and will carry two passengers and the pilot.

According to reports received today, claims of approximately $30,226,235 have been made against the Mexican Government by foreign interests owning property in Mexico, for damages sustained since the present government came into power.

American claims against the government totaled 139,914 pesos. Spanish interests have presented claims totaling 14,764,453 pesos. The Turks 3,530,467 pesos, Germans 1,095,400 pesos, French 282,841 pesos, Italians 272,497 pesos, Swiss 40,540 pesos, Chinese 38,663 pesos, Guatemala 20,000 pesos, English 9,907 pesos, Holland 7,770 pesos, Austria 3,225 pesos, and Mexican 10,020,558 pesos.

The National Safety Council has distributed a questionnaire covering the subject of industrial dermatoses or skin diseases occurring among employees engaged in certain manufacturing occupations. The latter include chemical manufacturing and munition plants, where compounds such as picric acid are used, and tanneries, where lime, acid, or dichromate frequently cause eczema. In the shoe industry, a hardening of the skin may occur on the abdomen from the worker pressing the shoe against his side for the purpose of steadying it, which in turn may result in chronic inflammatory skin disease. The questionnaire states such conditions are readily preventable.

Structural steel commitments during November, were 69 per cent of capacity, as compared with 77½ per cent the previous month, as reported by the Bridge Builders & Structural Society. This represents the booking of 123,500 tons.

The decline is in part seasonal. Business uncertainties arising from labor conditions were partly responsible. Most structural buying is for industrial extensions, report fabricating interests. Once railroad and commercial building projects come into the market, fabricators expect a demand beyond the capacity of their plants.

According to the Bridge Builders' reports structural commitments, the first eleven months of 1919 aggregated 1,004,400 tons, as against 1,148,400 tons the corresponding 1918 period. In 1918 some large orders for war plant steel were placed.

Venezuela has under way at Caracas its first national industrial exhibition, which comprehends manufacture, agriculture and live stock, the exposition closing February 8. The Government is to establish at Caracas a high-power wireless station to communicate with the United States and Europe, bids for which must be submitted before June 30.

MR. DANIELS DESCRIBES WORK OF CONSULTING BOARD

IN THE ANNUAL report of Mr. Josephus Daniels, Secretary of the Navy, for the year of 1919, there appears the following interesting commentary on the labors of the Naval Consulting Board:

When our country entered the war and the Council of National Defense undertook its gigantic task, it found the Naval Consulting Board a working and efficient organization and formally requested it to become the War Inventions Board. Its head, the distinguished Thomas A. Edison, gave virtually all his time to that board and to naval study and experiment. He lived much of the time on a ship, worked in close harmony with naval officers, gave valuable assistance in the fight against the submarine menace, and aided in other war measures. Under the direction of Mr. W. L. Saunders, active chairman, the members were assigned to special committees, and too much commendation can not be given to their devotion and contributions along many lines of war efficiency.

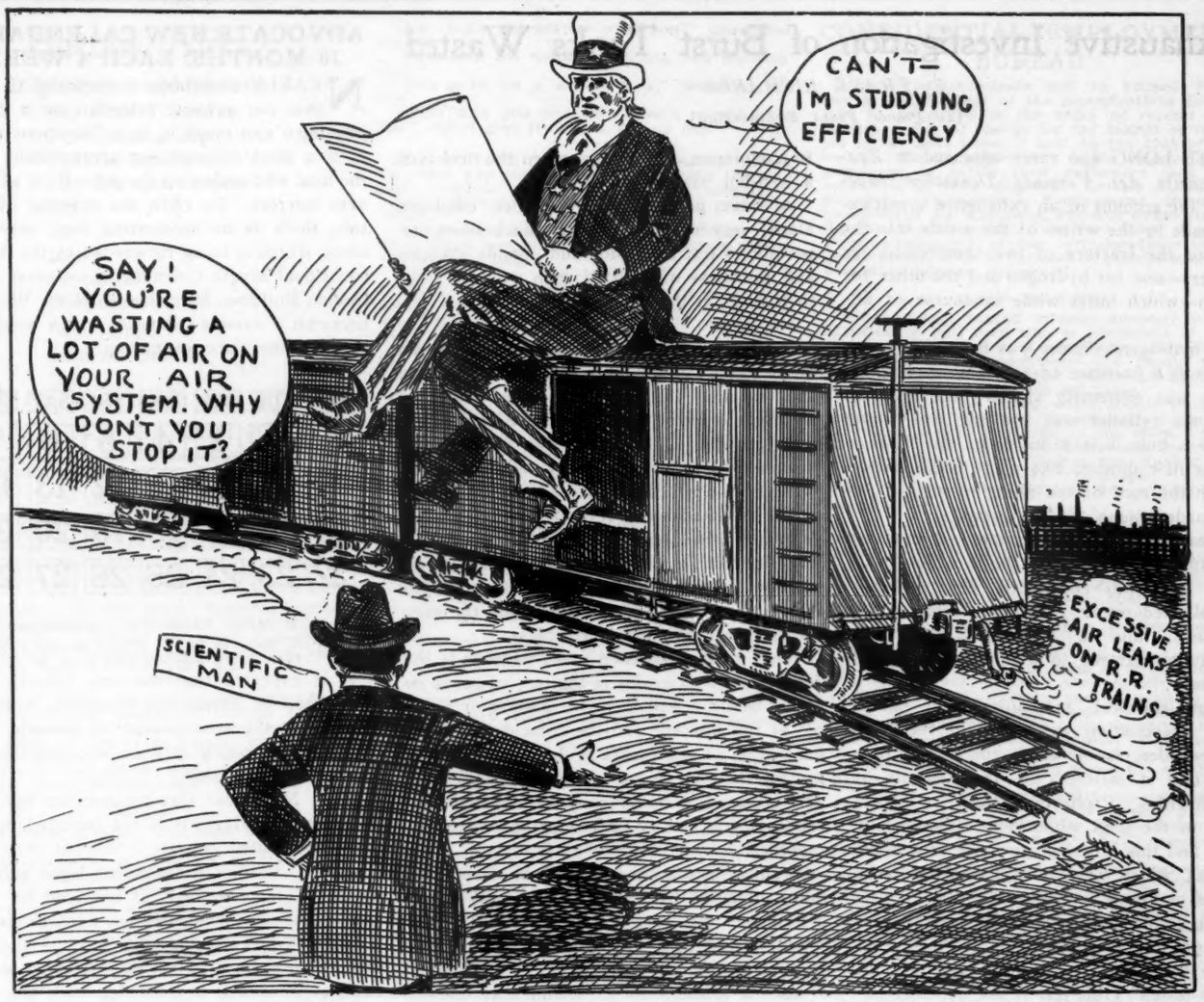
Beginning with the industrial inventory that stirred the country to a state of preparedness, and enlisted in this service a large number of technical men, the interest of scientists was thoroughly aroused by a special meeting in New York on March 3, 1917, at which there were present nearly all of the members of the board, representative naval officers, including Admiral Sims, and 35 well-known scientists representing principally the subjects of electricity, sound, and light. This was the first large gathering of highly trained technical men and naval officials held under the cognizance of the department. As a result of the meeting, considerable experimental work was undertaken particularly on the subject of submarine warfare, and several very interesting and instructive papers have been written and released for publication.

In June, 1917, the department found it advisable to place all activities on anti-submarine work under the direction of a special board with the commanding officer of the submarine flotilla as senior officer, and a member of the Naval Consulting Board was selected as advisory member of this board.

The ship protection committee of the Emergency Fleet Corporation, formed upon the initiative of Chairman Saunders, did work of special value to the merchant marine. Indeed, no subject received more study nor greater consideration from a large number of experienced authorities than that of protection of merchant vessels from submarine attack.

The New York office, under the management of the board's secretary, accomplished an immense amount of work in sifting ideas and granting interviews with those who submitted inventions or suggestions, and in this was ably assisted by the Chicago branch and the office in San Francisco.

One of the most important subjects investigated was that of the aerial torpedo and, while this device was not fully perfected, the difficulties are now understood, and we are nearer a solution of the problem.



TOO CLOSE VISION SPOILS THE PERSPECTIVE.

Possessing several members who are authorities in the science of areonautics, opinions of the board on many ideas submitted were of special value. Considerable research was undertaken in fuels and their handling, particularly with the reduction of smoke and lessening the visibility of vessels at sea, and through the work of the board the rate of insurance was reduced on vessels complying with instructions worked out.

A complete and illuminating history of the Naval Consulting Board since its organization in 1915 is being prepared under the direction of a committee of the board. It will deal particularly with the activities and useful and patriotic service of the members of the board during the World War and its preparation activities before the war, and will be one of the most valued stories of scientific war work.

USING CARBO-HYDROGEN FOR WELDING AND CUTTING

As a means of eliminating the disadvantages and dangers incident to the use of acetylene, the Carbo-Hydrogen Company of America, Pittsburgh, Pa., has developed a gas, which has been named carbo-hydrogen, as an efficient and safe medium for use in cutting and in certain classes of welding.

Carbo-hydrogen is a product of the destructive distillation of suitable hydro-carbons and has a general analysis of 85 per cent hydrogen, the balance being light hydro-carbons. It is a fixed gas, permanent under all weather conditions, and does not solidify or leave any residue in the tank. Being a combustible gas and not an explosive, it is easy to use and safer than acetylene.

Gases having a high B.t.u. value are necessarily slow in combustion and require a longer time to deliver a given amount of heat and a larger expenditure of oxygen than gases having a higher rate of combustion. For this reason a smaller portion of oxygen is needed for a given amount of work where carbo-hydrogen is used. The gas maintains a very high rate of combustion and ignition and consequently generates an intense heat.

In cutting ferrous metals gases having a high carbon content change the character of the metal at the cut, hardening it so that machining or caulking is exceedingly difficult. It is claimed that metal cut by the carbo-hydrogen process on the other hand retains soft surfaces that can readily be worked, while the absence of slag increases the speed of cutting and produces a smoother surface.

Among the advantages of carbo-hydrogen may be mentioned the absence of dangerous and poisonous gases in the products of combustion which often prove injurious to operators. Being composed largely of pure hydrogen, carbo-hydrogen burns almost entirely to water, while the combustion of acetylene and oxygen produces at least 50 per cent carbon monoxide. Carbo-hydrogen is supplied in drawn steel cylinders compressed to 1800 lb. per sq. in. The working pressure varies from five to ten lb, per sq. in., making it possible to withdraw practically all the gas from the tank.

Animal and vegtable oils both oxidize or gum on exposure to the air. Spread thinly over inflammable material, they will create spontaneous combustion. Linseed oil is an excellent example of gumming oil—highly desirable for paint but not for lubricating purposes. All seed oils have this common characteristic in greater or lesser degree.

Exhaustive Investigation of Burst Tanks Wasted

By FRANK RICHARDS

[In *Power Plant Engineering*]

NOT LONG ago there appeared in *Zeitschrift des Vereines Deutscher Ingenieure* the account of an exhaustive investigation made by the writer of the article into the cause of the fracture of two compressed gas cylinders—one for hydrogen and the other for oxygen—which burst while in course of filling.

The hydrogen cylinder was being filled with the gas at a pressure of 140 atmos. The explosion was extremely violent; the floor on which the cylinder was standing was found to have a hole in it 30 in. deep; the flask or cylinder flew upward like a projectile, passed through the roof of the filling room, and fell in a garden some 280 ft. distant.

An examination of the plant (compressor and fittings) revealed it to be in order.

The gas was produced electrolytically and collected in a gasholder, after which it passed into a two-stage compressor and was compressed to a filling pressure of 150 atmos.

A full chemical, mechanical and micrographic examination was made of the fractured cylinder, from which the writer concluded that it satisfied the requirements of the authorities. Probably a "fold" or crease formed in the steel while being mechanically treated, and this creasing gave rise to a crack or cracks, which were most likely the cause of the explosion.

He suggested that in addition to the prescribed precautions relating to the inspection of these vessels, each seamless vessel should be "flash-tested" (this test is not defined) before the head is put on, in order to find faulty places. This method has been adopted by the military authorities prior to the acceptance of all shells. This test would enable any creases to be discovered in the steel.

In the case of the oxygen cylinder a greater number of splinters were available.

The cylinder is said to have burst during the process of filling at a pressure of 80 to 100 atmos. The oxygen used was obtained from liquid air.

The cylinder was of similar construction to the hydrogen cylinder, being of the seamless-steel type. The same official regulations applied in this case also.

The article describes in detail the mechanical, chemical and other tests carried out on the fragments collected.

Numerous causes contributed to the bursting of the cylinder as shown by the experimental results.

The steel was weakened at one particular part where the test initials were stamped, as the stamp penetrated to half the wall thickness of the cylinder.

The steel was too brittle for the purpose in question. It was very sensitive to dynamic stresses.

The author suggested that the regulation regarding the stamping of these cylinders should be modified. The stamping should be reduced to a minimum, and be done when the steel is in a red-hot state.

A mere pressure test is, when employed alone, very defective. It is much more important to test the inside and outside surfaces and thickness of wall of each cylinder prior to putting on the top.

* * *

Basing my discussion on the above abstract of the report, it should have been immediately apparent that the explosions which occurred were not ordinary pressure explosions. They were not due to the giving way of the cylinder material under the regular and accustomed pressure for which they were designed and to which they had been previously subjected, and especially when apparently the limits of such pressure had not been reached; and the investigation as reported, based upon such an assumption, could throw no light upon the matter and was, of course, worthless.

What really happened must have been the formation of an explosive mixture of gases, or of gas and air, and then the ignition or firing off of the mixture and the coincident sudden generation of a pressure probably many times greater than the metal could have withstood. The occurrence, under a variety of different conditions, is not so infrequent as might be supposed.

The investigation should probably have been first conducted by chemists who could have determined the precise gases present, their condition and their proportions, and then the question would have been as to the production of such a temperature as would have caused spontaneous ignition of the explosive charge or mixture without the presence of spark or flame.

The means of producing the high temperature we are here looking for are distinctly suggested in even the few words which sketch the incident of the explosion. There may be and often is compression of air or gas, with the inevitably accompanying rise of temperature, without the intervention of any mechanical compressor. In the present case, the contents of the cylinders had been discharged in service and they were to be refilled. While they were, as we could think and speak of them, empty, they were really full of gas or air at a pressure not below atmospheric and perhaps somewhat above. When, by the operation of recharging the cylinders to the high pressure spoken of, the surviving contents of the cylinder, at low pressure and normal temperature, were compressed by the pressure of the incoming gas, and the temperature was raised correspondingly, so that if the constituents and the proportions of an explosive mixture were present, the explosion was sure to occur. Many "mysterious" explosions which have occurred in the recharging of high pressure receivers for air and for the various gases are thus easily explicable, but how they may be surely prevented it is not so easy to suggest. Certainly the recharging should not be done rapidly.

ADVOCATE NEW CALENDAR OF 13 MONTHS, EACH 4 WEEKS

NEARLY everybody is prepared to admit that our present calendar, as a certain physician expressed it, is a "ferocious mess." It is a most inconvenient arrangement. Ask the man who makes up the payroll, or who figures interest. To right the existing difficulties, there is an interesting new movement afoot, which is being forwarded by the American Equal Month Calendar Association of 400 Oneida Building, Minneapolis, Minn. We show herewith a sample calendar, which would always be the same, every year.

MON	TUE	WED	THU	FRI	SAT	SUN
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

THE NEW LIBERTY CALENDAR
This is all there is to it. Every month just like this for a million years or so

It is expected that the new Liberty Calendar will be adopted by Congress, when we will have thirteen months of exactly four weeks each, which will be accomplished in the following manner:

First, New Year Day becomes an independent legal holiday. It is not included in any week or month.

Second, another independent legal holiday, called "Correction Day" is provided for leap year. It is not included in any week or month.

Third, the remaining 364 days are divided into thirteen months of exactly four weeks each, every month commencing with Monday.

Neither the number nor length of our months is governed by the moon or any natural law, hence they can be changed as we see fit. The months in this new form are: January, February, Liberty, March, etc.

The use of the word "Liberty" is considered to be especially fitting, and in more ways than one.

The advantages of this form in saving of time and mental effort alone would be immense. All holidays and anniversaries would always fall on the same day of the week. A promissory note given for any number of weeks, months and years would always come due on the same day of the week it was given. The plan also provides that Good Friday and Easter Sunday shall always be observed on certain fixed dates. This was contemplated when our present calendar was adopted.

This simplified form has been approved by many authorities. It could be adopted to take effect on Sunday the first day of the year 1922, and the change would cause scarcely any jar or friction whatever, it is declared. A bill has already been introduced in Congress.

James McLean, prominent financier and vice-president of the Phelps Dodge Corporation, died in New York on January 7. Mr. McLean was also a director in numerous other companies including the Greene Cananea Copper Co. and the Old Dominion Company.

Buenos Aires

High Fares and Melons

For: *The New York Sun.*
The Evening Sun.
The Subway Sun.
The Elevated Express.
Nix.
Int.
Met.
Securities.
Holding.

Against: Jack Hylan.
8,000,000 others.
Us.

GOTHAM GLEANINGS

GOTHAM, January 5.—Doug Fairbanks played a screen engagement at the movie theatre recently.

Eddie Darville of the *Iron Age Catalogue* was a pleasant caller in this sanctum of late, inquiring whether there was any news of Leo Hanlon, of Washington, District of Columbia, the Nation's Capital, the which there was.

Leo. Hanlon, the well known business negotiator of Washington (District of Columbia) was a Gotham, N. Y., visitor last week, and phoned ye ed an invite to lunch, later cancelling same. Better luck next time, Leo, say we.

Charley P. Craig, the well known and popular St. Lawrence canal booster of Duluth, (Minn.) and who hobnobs with governors and legislatures and all kinds of important people, was a pleasant caller on ye Cor. not long since. Charley is not a half bad fellow and will get that St. Lawrence River improvement built sure some day.

Much winter weather has been had in these environs and vicinage of late but meteorologically the season so far can't hold a candle to what it was two winters back.

Your cor. received a Xmas present of a new manicure set and has been wondering since whether it was a hint to cut out that 40-year-old blonde manicure expert, or a tip that we hadn't been visiting her often enough.

Echoes here in Main Street are that politics are seething pro and con, mostly con, down in Washington (District of Columbia) and that the Dems and Reps expect a lively-like campaign this Leap Year.

DOWNTOWN.

Jimmy Montague observes that our immigrants used to be green, but now they're mostly red. More *truth* than *poetry.*

Our friend, Rome Fenton, the popular heavyweight and tenor, as well as expert domino and rummy player, sang for the I-R Club at Easton, Pa., recently and made an emphatic hit, according to private wireless advices we have received. Rome knocks 'em dead, as they say on B'way, with either his voice or his right. It was Mr. Fenton who was in mind when the phrase became current, "Rome was not built in a day," and even one R. Browning said, "Everyone, soon or late, comes round by Rome."

Pilfered from Poachers

"I tell you I won't have this room," protested the old lady to the bell boy who was conducting her. "I ain't agoing to pay my good money for a pigsty with a measly little foldin' bed in it. If you think that just because I'm from the country ——"

Profoundly disgusted, the boy cut her short. "Get in, mum. Get in," he ordered. "This ain't your room. This is the elevator."

Two London cabbies were glaring at each other.

"Aw, wot's the matter with you?" demanded one.

"Nothink's the matter with me, you bloomin' idiot."

"You gave me a narsty look," persisted the first.

"Me? Why you certainly have a narsty look, but I didn't give it to you, so 'elp me."

"George," said the Titian-haired school marm, "is there any connecting link between the animal kingdom and the vegetable kingdom?" "Yeth, ma'am," answered George promptly, "Hash."

It may have been George's sister, Nellie, who when asked how to make a Maltese cross, replied "Step on its tail."

"John, John," whispered the alarmed wife, poking her sleeping husband in the ribs. "Wake up, John, there are burglars in the pantry and they're eating all my pies."

"Well, what do you care," mumbled John, rolling over, "so long as they don't die in the house?"

"Fust time you've milked a cow, is it?" said Uncle Josh to his visiting nephew. "Wal, y' do it a durn sight better'n most city fellers do."

"It seems to come natural somehow," said the youth, flushing with pleasure. "I've had a great deal of practice with a fountain pen.'

The little daughter of the house awoke one morning to be greeted with the tidings that she had a new little brother, who had arrived the night before. "You can't imagine who brought him," said the nurse. The little one thought a moment, and then said brightly

"Oh, yes, now I know; it was the milkman."

"Why the milkman?" was asked in a surprised tone.

"Because it says on his wagon, 'Families Supplied,' of course," was the answer.

"What have you got in the shape of cucumbers this morning?" asked the customer of the new grocery clerk. "Nothing but bananas, ma'am."

"Are you related to Barney O'Brien?" Thomas O'Brien was once asked.

"Very distantly," Thomas replied. "I was me mother's first child—Barney was the sivinteenth."

"Johnny," said the teacher, "if coal is selling at $6 a ton and you pay your dealer $24, how many tons will he bring you?" "A little over three tons, ma'am," said Johnny promptly. "Why Johnny, that isn't right," said the teacher. "No, ma'am, I know it ain't," said Johnny, "but they all do it."

Our idea of a snappy moving picture title is to be seen in *The Hoodlum,* in which Mary Pickford's shimmy dancing partner of the slums says to her in appreciation of her terpsichorean abilities: "Say kid, you can certainly shake no mean hoof!" We noted, too, that she shook a wicked shoulder.

Old Stewart Ives DeKrafft, of the Broadway College of Heralds, who now has his trusty Corona out with the *Roly Boly Eyes* road Co., was a recent caller at this sanctum, relating droll tales of his wayfarings in the lusty west.

One of these here now funny writers for the newspapers thinks it may not be altogether necessary to state that a chap named Cheatem is a taxi driver at Greenville, Ala. And while on the subject of pat patronymics we see no reason for withholding the intelligence that there is a cheerupodist of the monicker Sunshine in upper Broadway, nigh 92nd Street, N. Y. City.

Reversing the English

Sign near Plainfield, N. J.: Masonery and Plastring.

It is a case of winding up this colyum for the month, toot sweet, and the sweeter the better, as the ex-doughboys say.

BAWMIE INTHEBEAN.

CONFIDENTIAL EMPLOYMENT BUREAU

NOTE—Announcements not to exceed forty words, under either of the classifications below, will be published in the order of receipt and published free of charge for the benefit of readers in the next issue, if sent by the 25th of the month. Display advertisers in the magazine are privileged to notify their customers that this service is at their disposal. Letters should be directed, "Confidential Employment Bureau," Compressed Air Magazine, Bowling Green Building, No. 11, Broadway, New York City. Replies to advertisements, or any correspondence in regard thereto, will be forwarded promptly to the person or persons concerned.

HELP WANTED

445—Arizona copper mining company wants experienced mill man who is competent to take charge of night shift, if necessary. Experience in installation of machinery and repair work most desirable. State full details in first letter and when services are available.

446—Contractor doing construction work in Detroit wants assistant superintendent capable of taking complete charge of the work. Must be forceful, energetic and competent to handle large number of men. Only a man having held similar position will be acceptable. Liberal salary. State when services are available in first letter.

POSITIONS WANTED

No. 379—Recently discharged as Captain in Coast Artillery Corps after two and one-half years service. A graduate mining engineer with seven years' general engineering experience, including power plant operation, construction work, surveying, tunneling and plant design in Arizona and Cuba. Desires position in New York or vicinity.

No. 880—Technical man with five years' experience in sale and purchase of steel products and non-ferrous metals. Also in mill supplies. Desires position wherein past experience will be useful as purchasing agent or assistant in large company or in the sales department.

No. 881—Young man familiar with general repair work, contracting, taking charge of accounts, would like position where his experience will prove valuable.

No. 882—Man familiar with manufacture of gas engines; assembling, machine shop practice, etc., desires position with large automobile company as service man. Fully competent. References.

No. 883—Experienced technical engineer familiar with European coal mining operations for many years in numerous localities, desires a position in the United States where his qualifications will prove available. Further details and references will be furnished in letter.

John Barrett, director-general of the Pan-American Union, has announced to the governing board of the organization that he will retire from office June 30, 1920, the end of the present fiscal year. Mr. Barrett explained to the board, composed of the ambassadors and ministers of Central and South American nations to the United States, that he finds it necessary to quit the union and accept a more lucrative position in order to provide for his old age. He said he is to become president of a new unofficial pan-American organization for developing international commerce in the western hemisphere. Mr. Barrett has been connected with the Pan-American Union fourteen years.

The three minerals most needed to make our agricultural industry more productive and more prosperous are potash, nitrate, and phosphate. Most of the potash and nitrate we use is imported, but our domestic supplies of phosphate are abundantly ample to meet all our requirements, and for years we have been heavy exporters to Europe. The total quantity of phosphate rock in the United States in 1918 was nearly 2,500,000 long tons, having a value of more than $8,000,000, over twice as much as was produced in that year in all the rest of the world. Florida alone produced more than 2,000,000 tons, having a value of about $6,000,000.

Latest U. S. Patents

Full printed uncertified copies of specifications and drawings of any patent may be obtained by sending ten cents (not stamps) to the Commissioner of Patents, Washington, D. C.

NOVEMBER 25

1,322,506. PNEUMATIC-ELECTRIC CIRCUIT-CLOSER. John T. Austin, Hartford, Conn.

1,322,588-9. MILKING-MACHINE PULSATOR. Meredith Leitch, Poughkeepsie, N. Y.

1,322,597. APPARATUS FOR MOISTENING AIR. William Millard, New York, N. Y.

1,322,726. GLASS GATHERING AND BLOWING MACHINE. Michael J. Owens, Toledo, Ohio.

1,322,783. AIR-BRAKE MECHANISM. Alva L. Goodknight, Heavener, Okla.

1,322,804. AIR-DRIER. Bernarr Macfadden, New York, N. Y.

1,322,843. METHOD FOR MAKING RUBBER RINGS AND THE LIKE. Harry E. Townsend, Brooklyn, N. Y.

1. The method of inserting and removing formers from plastic articles and the like which consists in placing the article on a former; then performing the finishing operation upon the said article; then introducing fluid under pressure between the said former and the finished article; and then removing the finished article from the former and maintaining the layer of fluid under pressure entirely around the former during the removing operation.

1,322,907. OZONIZER. Ephraim D. Klots, New York, N. Y.

1,323,014. DESICCATION OF AIR OR GASES. Georges Claude, Paris, France.

1,323,015. DEVICE FOR SKIMMING OR CREAMING MILK. Rene Clavel, Basel, Switzerland.

1. A device for skimming or creaming milk, comprising a recipient intended to receive the milk to be skimmed and containing at least one finely porous hollow body through which a gas under pressure can be introduced in the said milk for transforming the latter into foam or froth, an overflow at the top of the said recipient and means for separating the cream from the whey after the bursting of the milk foam bubbles supplied by the said overflow.

1,323,093. AIR-BRAKE. Eber Francis Piers, Ogden, Utah.

1,323,217. VENTILATING-MASK. George E. Darrow, San Francisco, Calif.

DECEMBER 2

1,323,308. PROCESS FOR VAPORIZING LIQUIDS. Nils Emel Norstrom, Chicago, Ill.

5. The process of vaporizing oil which consists in subjecting it to contact with air under compression and subsequent free expansion and thereby vaporizing the oil.

1,323,328. HOT-BLAST VALVE. Edwin E. Slick and Fredellia H. Moyer, Westmount borough, Pa.

1,323,587. LIQUID-COOLING APPARATUS. Joseph Elger, Chicago, Ill.

1,323,610. COLLAPSIBLE AND FOLDABLE PNEUMATIC BED. George B. Price, Topliff, Utah.

1,323,615. SPEED-GOVERNING MEANS FOR MOVING SHEETS. Charles F. Stoddard, New York, N. Y.

1,323,627. AUTOMATIC TRAIN-STOP. Jacob Gut, Cleveland, Ohio.

1,323,666. APPARATUS FOR TREATING AIR OR OTHER GASES. William Henry Yardley, Sheffield, England.

1,323,676. MILKING-MACHINE. Albert Close, Plainfield, N. J.

1,323,688. FLUID-PRESSURE JACK. Edmund Graham and George Bowman, Belfast, Ireland.

1,323,854. AUTOMATIC COMPRESSING-TANK. John W. Ginter, Eau Gallie, Fla.

1,323,864. APPARATUS FOR PUMPING LIQUIDS. Arnold H. Human, Gerrards Cross, Buckinghamshire, England.

1,323,889. AIR HEATER AND DISTRIBUTER. Charles R. Mabee, Toledo, Ohio.

1,323,925. VACUUM CLEANING DEVICE. Claude W Stewart, Martinsburg, W. Va.

1,323,955. AUTOMATIC PRESSURE-COMPENSATOR. Hoyt H. Bohannon and Clyde Z. Harden, Ashburn, Ga.

DECEMBER 9

1,324,056. COMPRESSING-ENGINE. Samuel Lippert, East Cleveland, Ohio.

1,324,059. AIR VENTILATION SYSTEM. Samuel W. Mead, Weston, Mass.

1,324,072. PROCESS OF AND APPARATUS FOR DEHYDRATING FRUITS, VEGETABLES, Etc. Chauncey Shorman, Chicago, Ill.

1. In a dehydrating apparatus, the combination with a closed receptacle for containing the articles to be treated, of means for exhausting the air from said receptacle and compressing the exhausted air, means for condensing the moisture in the compressed air, means for heating the said air, and means for returning the dried air to the receptacle.

1,324,078. PERCUSSIVE TOOL. William A. Smith, Easton, Pa.

1,324,079. COMPRESSOR SYSTEM. Lyle K. Snell and Frank Johnson, Detroit, Mich.

1,324,137. VALVE FOR AIR-COMPRESSORS. Oscar Ragnar Wikander, Pittsburgh, Pa.

1,324,324. APPARATUS FOR AUTOMATICALLY CONTROLLING, STARTING AND STOPPING FLUID-COMPRESSORS. John E. Schmidt and Clyde E. McArthur, Chicago, Ill.

1,324,327. LUBRICATING ARRANGEMENT FOR PNEUMATIC ROCK-DRILLS. Thomas Turner, Ottumwa, Iowa.

1,324,416. VACUUM-SWEEPER. Claude W. Stewart, Martinsburg, W. Va.

1,324,635. VACUUM-CLEANER. Louis Daniel Ascoli, Hornchurch, England.

1,324,705. INTAKE-UNLOADER FOR COMPRESSOR SERVICE. Charles Wainwright, Erie, Pa.

1,324,772. PNEUMATIC GUN. Nelson Goodyear, New York, N. Y.

DECEMBER 16

1,324,894. AIR-PUMP. Jacob Hauser, Rochester, N. Y.

1,324,944. AIR-COOLED VEHICLE-TIRE. Thomas C. Watkins, Ingram, Pa.

1,325,006. MOLDING-MACHINE. John W. Dearsley, Racine, Wis.

1,325,012. LOW-AIR-PRESSURE SIGNAL. David D. Getman, White Butte, S. D.

1,325,040. FLUID-METER. Horace N. Packard, Milwaukee, Wis.

1,325,180. VACUUM FEED APPARATUS. Frederick Weinberg, Detroit, Mich.

1,325,255. CENTRIFUGAL COMPRESSOR. Louis C. Loewenstein, Lynn, Mass.

1,325,288. AIR-BRAKE SIGNAL. William J. Greb, Easton, Pa.

1,325,388. MANUFACTURE OF GLASS BOTTLES AND IN GLASS SHAPING AND BLOWING MACHINE THEREFOR. Arthur Wilzin, St. Ouen, France.

1,325,415. METHOD OF TREATING VARNISHED (PATENT) LEATHER. Heinrich Schulz, Worms, Germany.

The herein-described method of treating varnished leather, which consists in subjecting the leather to the action of light rich in ultraviolet rays in a closed chamber; and continuously forcing air, previously heated to a temperature above 40 degrees Reaumur, into said chamber and exhausting it therefrom.

1,325,500. PNEUMATIC MOTOR. Adolph P. Gustafson, Chicago, Ill.

ELECTRICAL MACHINERY DEMAND ABROAD

The great increase in the price of coal throughout the world has made fuel economy a most pressing problem. Reports reaching the National Foreign Trade Council denote a tremendous and continued opportunity for the American Electrical Manufacturing Industry in supplying the needs of these countries which are now forced to develop their electrical power to the utmost.

Large railroad electrification projects are soon to be carried out in Italy and South Africa. In the former country, 800 million lire will be spent for electrification of 6000 kilometers of railroads. Portugal will probably follow in Italy's footsteps. Many of the South American countries are studying this problem, and Bolivia has just declared as public domain, the watersheds of the rivers having sufficient power for that purpose. Throughout Chile, many power plants are being built.

In France, a Bill recently passed both Houses and has become law for the canalization of the Rhône from Lake Geneva to the Mediterranean. The swiftness of the current of this river will be modified by means of a series of locks and dams, the latter being utilized to generate electric energy and for irrigating purposes. Nineteen large generating stations are to be provided which will furnish electric energy rendering from 12,000 to over 70,000 h. p. per station. It is estimated that the river is capable of generating energy equivalent to 760,000 h. p. or 4,848,000 kilowatt hours annually, which is equal to a saving of nearly 500 million tons of coal. Two hundred thousand k. w. of the energy generated is reserved for the use of consumers in Paris at the price of two cents per k. w. (locally generated energy now costs ten cents). The balance of 560,000 h. p. will be utilized by metallurgical, electro-chemical and other industries in the Rhône valley, for electric traction on the Rhône, for the electrification of a portion of the Paris, Lyons and Mediterranean Railway, pumping irrigation water and other purposes. The cost is estimated at two billion five hundred thousand francs.

THE APOGEE AND THE ZERO OF "DIRECT ACTION"

Once upon a time there was a Trade Union which grew so big and powerful that it was able to absorb all the other Trade Unions. Ultimately it became known as The Union, and Everybody had to join it. A National Programme was drawn up and a Great Conference was arranged. It was unanimously decided that in the event of the National Programme being refused a General Strike should take place. There was nobody left outside The Union either to concede or refuse the demands of the National Programme, so a General Strike began. Everybody in the country stopped work and Everybody drew Strike Pay. But there was nothing to Buy with the Strike Pay, for Nobody was making anything, so Nobody could sell anything.

So everybody died in a Desperate Attempt to live at the expense of Everybody Else.

And then the Union came to an End.

Oscar F. Greely, formerly manager for the La Paloma Mining Company near Mazatlan, Mexico, is examining properties at Rochester, Nevada. Mr. Greeley found it impossible longer to contend with difficulties in Mexico, where the repudiation of paper currency is of almost daily occurence, and will endeavor to find a property in Nevada to his liking. He resides in San Francisco.

F. C. Biggert, Jr., for a number of years chief engineer and second vice-president of the United Engineering & Foundry Co., Pittsburgh, has been made president of the company. He succeeds Isaac W. Frank, who recently resigned, but who will serve as chairman to the executive board. K. C. Gardner, former manager of sales of the rolls department, has been elected to succeed Mr. Biggert as second vice-president.

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